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AN ECONOMIC ANALYSIS OF AIR TRAFFIC  
GROWTH WITH SPECIAL REFERENCE TO  
JAMAICA

A DISSERTATION SUBMITTED IN PARTIAL  
FULFILLMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF  
DOCTOR OF PHILOSOPHY

By

NEVILLE G. BEMBRIDGE

THE UNIVERSITY OF MANITOBA

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AN ECONOMIC ANALYSIS OF AIR TRAFFIC  
GROWTH WITH SPECIAL REFERENCE TO  
JAMAICA

BY

NEVILLE G. BEMBRIDGE

A thesis submitted to the Faculty of Graduate Studies of  
the University of Manitoba in partial fulfillment of the requirements  
of the degree of

DOCTOR OF PHILOSOPHY

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## ABSTRACT

### An Economic Analysis of Air Traffic Growth with Special Reference to Jamaica

Air transport and international tourism are closely related. This relationship has grown out of important developments in the air transport industry since World War II, especially the "jet revolution" beginning in the late 1950's. This study has investigated that relationship and the economic and public policy implications for tourist host countries with particular emphasis on Jamaica.

First, the growth of air traffic was investigated by analyzing the productivity-cost-price nexus in the air transport industry; analyzing the demand for air transport, including the derivation of elasticity coefficients; and projecting air traffic growth to Jamaica. Next the economic impact of this traffic growth on the host country was analyzed. This involved a critique of multiplier analysis used in other studies, and a discussion and application of the social marginal productivity technique as an alternative. Finally, public policy alternatives were examined in a social marginal productivity framework.

The investigation revealed that the rise in airline productivity associated with jet technology reached its peak during the 1960's when its average annual rate of increase was more than twice that of subsequent years. The real cost of operation and real prices (fares) have moved in conformity with these changes thereby maintaining their inverse relationship with productivity. The demand for air transportation to Jamaica was found to be price-elastic; air traffic growth to that country has tapered off with price increases. Projections made in this study indicated that even slower rates of air traffic growth are in prospect.

In conclusion, the growth of air traffic to Jamaica has been strongly linked with the growth of productivity associated with jet aircraft technology. This traffic growth has imposed an important change in the nature of the Jamaican tourist industry with the result that the country has become largely dependent on that industry for economic benefits. The assessment of these benefits has often been defective and may have misguided Jamaican public policy into promoting costly misallocations of resources. Declining tourist traffic to Jamaica need not diminish, and could even increase, the net benefits to Jamaican nationals.

## CHAPTER I

### INTRODUCTION

Air transportation during the post-World War II era has been characterized by some important developments which have had a major impact on the growth of international tourism; and this in turn raises important economic impact and public policy issues for tourist host countries like Jamaica. The factors that have contributed to the growth of international air traffic are of different, though not unrelated types. On the one hand, there have been changes in aircraft technology, reflected by what has been dubbed "the jet revolution." Beginning in the late 1950's, and continuing through the 1960's into the present, the use of jet equipment has been an important feature of the air transport industry. Jet equipment can be identified with certain traffic-luring potentials, ranging from its ability to lower operating cost and hence the level of price (fare), to its greater speed (or less flying time per trip), and greater comfort and safety.

On the other hand, the travelling public of the major tourist-generating countries of the world has been quite responsive to the features of jet technology indicated above. The most evident response pertains to the downward trend in air fares which accompanied the use of jet aircraft by commercial airlines up to about the mid-1970's. That is, air traffic volume has grown at a faster rate than the reduction in air fares, as will be seen later in this study. At the same time, real personal and family incomes in the tourist-generating countries have risen, population has grown, and travel promotion has been intensified. These developments have all contributed to the growth of air traffic.

The growth of international tourism parallels the growth of international air traffic. International travel for business purposes tends to be less postponable, or

more indispensable than such travel for purposes of tourism. Thus much of the responsiveness to the developments indicated above is attributed to tourist or pleasure travel rather than to business travel; and consequently, the growth of international air traffic implies the growth of international tourism. This is certainly true of Jamaica where nearly all of the international visitors have tourism as their purpose of travel to that country.

Given the above observations, it will be the purpose of this study to investigate the relationship between air transportation and the growth of international tourism, and to seek the economic and public policy implications for the tourist-recipient country. Although the investigation will focus on Jamaica, a more general framework will sometimes be necessary for perspective purposes. For instance, the tourist traffic market relevant to Jamaica is affected by air transport developments in the politically western world. Thus it is necessary to examine the air transport industry in that broader context.

The study will be conducted in three parts. In Part I the focus will be on investigating the growth of air traffic by analyzing the underlying economic forces. Specifically, the productivity-cost-price nexus as it relates to the air transport industry will be investigated.

Underlying the concept of productivity is the concept of the production function which is defined for a given level of technology. A change in technology shifts the production function, and such shifts reflect corresponding productivity changes. Technological change is defined as being economically meaningful when it permits the production of a given output with less inputs, or the production of more output with unchanged inputs. For example, the adoption by an airline of a new aircraft type which allows it to produce more output without any relative increase in inputs indicates that this airline (firm) has experienced a positive (favorable) shift of its production function, and correspondingly an increase in its productivity.



Rising productivity is synonymous with lower unit cost of production which when passed on to consumers will result in a larger quantity of the product being demanded. Where the demand for the product is elastic, the profit-maximizing firm will have a strong incentive to share this productivity-induced cost saving with users of the product by cutting its price; for in so doing the firm's total revenue will rise, and with the lower cost indicated above, the profitability of the firm would be enhanced.

It is this impact of productivity and cost changes on price and product demand in the air transport industry that is of primary interest in this study's analysis of air traffic growth. This will be the concern of the next four chapters comprising Part I. In Chapter II (and Appendix A) the supply of air transportation will be analyzed. There the concept and measurement of productivity will be discussed and applied; then the relationship between productivity and cost will be explored.

The effect on product price (air fare) of this relationship will be examined in Chapter III which deals with the demand for air transportation. The analysis of this chapter will focus on the elasticity of demand, including the derivation of estimates of price and income elasticity coefficients. In Chapter IV the nature of competition and pricing in the air transport industry will be investigated within the context of market structure<sup>1</sup> analysis. The dimensions of the market that will be investigated are the number of firms and their behavior, the conditions of entry, and pricing as administered by the industry's rate-fixing machinery—the International Air Transport Association (IATA). The implications of each of these factors for the growth of air traffic and international tourism will be sought as they are discussed.

Having investigated the past growth of air traffic in the previous chapters, an attempt will be made in Chapter V to forecast the future growth of traffic to Jamaica. This will be accomplished by means of trend extrapolation of the

independent variables in the demand analysis of Chapter III. This simple technique will be employed with full awareness of its underlying assumptions and limitations.

In Part II of this study the focus will be on the economic impact of international tourism on the host country. It is presumably because of this impact that host countries like Jamaica will be concerned with the growth of traffic investigated in Part I. Attempt has been made by several studies<sup>2</sup> to determine the contribution of tourism to different economies. In doing so, the technique most often used has been multiplier analysis. This study will offer a brief review and critique of the multiplier analysis as employed by those studies. Specifically, it will be argued that such analysis may not be particularly appropriate for application to less developed countries like Jamaica, given the underlying assumptions of the theoretical framework on which such analysis is based. Secondly, the simple multiplier analysis does not sufficiently address such matters as the balance of payments effect and the capital intensity of investment which are of particular importance to developing countries. In addition, it should be noted that while abuse is not a criticism of the multiplier technique per se, such abuse has characterized some applications of that technique with the result that the economic impact of tourism has often been exaggerated.

In light of the charges levied against the multiplier analysis, this study will propose and apply an alternative methodology aimed at achieving a more satisfactory assessment of the economic contribution of international tourism to the host country. This alternative is the social marginal productivity framework. It is more comprehensive than the multiplier technique in that it permits analysis of the economic potential of the tourist industry in terms of a number of subcriteria.<sup>3</sup> In particular, it allows the capital intensity and balance of payments concerns indicated above to receive the appropriate attention which is denied by the simple multiplier analysis. The application of the social marginal productivity criterion by this study will focus on the Jamaican tourist industry, but the analysis and results

could be relevant to other countries and areas such as those with similar natural resources, and in a similar stage of economic development.

The economic contribution that international tourism makes to the host country is largely determined by the policies pursued by the government of that country. Thus Part III of this study will examine the measures that the government may take to influence that contribution in the best interest of the nationals of that country. Given the projected trend of tourist traffic growth (Part I), Part III also examines the public policy alternatives relative to that trend. All these policy issues are investigated within the social marginal productivity framework.

The data on which this study is based are primarily time series (annual) data derived from a variety of sources. However, the principal sources were publications of the International Civil Aviation Organization (ICAO), the International Air Transport Association (IATA), the Dun and Bradstreet Corporation, and the Jamaican Government. The ICAO and the IATA publish a wide range of documents, circulars and special reports dealing with various aspects of international air transportation. Of particular benefit to this study was the ICAO circular series which periodically provides "A Review of the Economic Situation of Air Transport." This proved to be the most versatile single source in terms of the broad range of topics on which annual data are reported.

The Dun and Bradstreet Corporation publishes "Official Airline Guides (OAG) which contain information on air fares and airline schedules. The North American editions of OAG provided the relevant data for this study. Two Jamaican Government annual publications were of special importance as data sources for this study. These are "Economic and Social Survey of Jamaica," prepared by the National Planning Agency of Jamaica, and the "Report of the Jamaican Tourist Board." These sources were particularly useful in providing data on North America-Jamaica tourist traffic.

Data collection for this study concentrated on the period 1960-1980. However, any relevant data outside of this period were incorporated if they were believed to enhance the quality of the analytical results. On the whole, the quality of the available data is reasonably satisfactory, and the problems encountered are not unusual for time series. That is, available historical data are often incomplete or discontinuous, and when compiled from more than one source may be subject to some variation of definition and measurement. For these reasons this study had to exercise some dexterity in manipulating the available data in order to help achieve consistency and completeness of some series. This involved some interpolation and extrapolation, but even so these operations were necessary only to a limited extent. Despite reasonable satisfaction with the data used, anything less than "perfect data" should be accompanied by the usual caveat that the final results are no better than the data inputs. Further details and discussion of specific variables will be found throughout the study.

## CHAPTER I

## NOTES

1. It is recognized that the supply and demand factors previously referred to are elements of market structure analysis. However, the focus of this analysis will be different from that of the earlier analysis.
2. See examples in Chapter VII of this study.
3. See Chapter VII and Cf. Hollis B. Chenery, "The Application of Investment Criteria," in the Quarterly Journal of Economics, February 1953, pp. 76-96; and H. Peter Gray, International Travel - International Trade, D. C. Heath and Company, Lexington, Massachusetts, 1970, pp. 141-152.

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## PART I

### THE GROWTH OF AIR TRAFFIC

## CHAPTER II

### SUPPLY OF AIR TRANSPORTATION

In investigating the influence of supply factors on air traffic growth, this study will explore the ramifications of productivity changes in the air transport industry. The argument proposed here is based on the familiar productivity-cost-price relationship assumption. Within the context of air transportation this means that increased productivity in the industry has resulted in reduced unit operating cost, and this cost reduction has contributed to lower air fares which in turn enhances air traffic growth.

The first task therefore is to investigate productivity developments in the industry. This will be accomplished by examining changes in the industry's rate of output and the related changes in those characteristics of the commercial aircraft that determine the output results. In addition Appendix A provides a detailed discussion of the concept and measurement of productivity, and derives some alternative estimates of air transport productivity.

#### Productivity Developments in the Air Transport Industry

An examination of the changing composition of the aircraft fleet of the international airline industry provides some background information that is relevant to the investigation of productivity changes in that industry. With the introduction of jet technology and the distribution of aircraft types in the world aircraft fleet rapidly changed to exhibit the predominant use of jet equipment. For example, when jets were first introduced into service in 1958 they comprised less than one percent (0.3%) of the world's aircraft fleet. By 1969 they accounted for nearly one-half (49.2%) of that fleet, and by 1980 approximately 71 percent of all aircraft

in use by international scheduled airlines were jets, (Table II-2).

This change in the composition of aircraft fleet has been accompanied by large increases in air transport productivity expressed in terms of tonne-kilometres available per hour (TKA/Hr.). On the basis of this measure productivity increased by 43.7 percent over the seven pre-jet years ending in 1957. With the introduction of jet aircraft into service in 1958, productivity rapidly increased such that over the next five years (1958-1963) its rate more than doubled (106.5% increase). By 1980, productivity was almost six times (586.8%) as large as it was when jet aircraft were first introduced into service, (Table II-3).

Despite the productivity gains indicated above, a further look at Table II-3 reveals that the relative increases have been slower in the more recent years of the study period. When comparisons are made on the basis of the three decades<sup>1</sup> involved, it is seen that between 1950 and 1959 productivity increased by 78.8 percent (from 1637 to 2927 TKA/Hr.). Much of this increase can be attributed to the use of jet aircraft, for if the two years (1958 and 1959) of jet operation are excluded that productivity increase would have been only 43.7 percent. Over the decade of the "sixties" (1960-1969) productivity increased by 133.5 percent (from 3609 to 8426 TKA/Hr.), but for the period 1970-1979 the increase was only 58.8 percent (from 8991 to 14280 TKA/Hr.).

These data indicate that the decade of the "sixties" experienced the most rapid rate of growth of air transport productivity, a result attributed to the increasing momentum during that period of the so-called "jet revolution." They also indicate that the decade of the "seventies" was one of declining growth in productivity and therefore suggest that the jet revolution has been losing its momentum in more recent years. Note that of twenty-eight jet aircraft types in commercial service in 1980, sixteen or 57.1 percent first entered into service during the "sixties," (Table II-4). Included among these is the Boeing 727 which was introduced into service in 1963, rapidly grew in number and since 1967 has



TABLE II-1

NUMERICAL DISTRIBUTION OF AIRCRAFT TYPES  
INTERNATIONAL SCHEDULED AIRLINES,\* ICAO  
CONTRACTING STATES,+ 1950-1980.

| Year | Aircraft Category |                        |      | Total |
|------|-------------------|------------------------|------|-------|
|      | Piston Engine     | Turbo-Prop<br>(Number) | Jets |       |
| 1950 | 3061              |                        |      | 3061  |
| 1951 | 3253              |                        |      | 3253  |
| 1952 | 3515              |                        |      | 3515  |
| 1953 | 3514              |                        |      | 3514  |
| 1954 | 3530              | 33                     |      | 3563  |
| 1955 | 3659              | 98                     |      | 3757  |
| 1956 | 3856              | 165                    |      | 4021  |
| 1957 | 4123              | 263                    |      | 4386  |
| 1958 | 4092              | 416                    | 12   | 4520  |
| 1959 | 4048              | 639                    | 130  | 4817  |
| 1960 | 3903              | 723                    | 388  | 5014  |
| 1961 | 3666              | 847                    | 609  | 5122  |
| 1962 | 3550              | 897                    | 766  | 5213  |
| 1963 | 3484              | 933                    | 871  | 5288  |
| 1964 | 3438              | 944                    | 1043 | 5425  |
| 1965 | 3276              | 997                    | 1310 | 5583  |
| 1966 | 2956              | 1138                   | 1687 | 5781  |
| 1967 | 2633              | 1310                   | 2214 | 6157  |
| 1968 | 2408              | 1379                   | 2932 | 6719  |
| 1969 | 2112              | 1478                   | 3472 | 7062  |
| 1970 | 1987              | 1531                   | 3757 | 7275  |
| 1971 | 1804              | 1541                   | 3998 | 7343  |
| 1972 | 1669              | 1562                   | 4233 | 7464  |
| 1973 | 1545              | 1538                   | 4533 | 7616  |
| 1974 | 1498              | 1512                   | 4847 | 7857  |
| 1975 | 1456              | 1512                   | 5145 | 8113  |
| 1976 | 1398              | 1505                   | 5343 | 8246  |
| 1977 | 1348              | 1475                   | 5516 | 8339  |
| 1978 | 1269              | 1416                   | 5695 | 8380  |
| 1979 | 1230              | 1400                   | 5960 | 8590  |
| 1980 | 1184              | 1379                   | 6194 | 8757  |

Source: International Civil Aviation Organization, A Review of the Economic Situation of Air Transport, Circular 105-AT/26; Circular 122-AT/32; Circular 158-AT/57; Circular 73-AT/10; The Economic Implications of the Introduction Into Service of Long-Range Jet Aircraft, Doc 7894-C/907.

\*Including their domestic operations.

+Excluding U.S.S.R.

TABLE II-2

PERCENTAGE DISTRIBUTION OF AIRCRAFT TYPES,  
INTERNATIONAL SCHEDULED AIRLINES, ICAO  
CONTRACTING STATES, 1950 - 1980.

| Year | Aircraft Types |                         |      | Total |
|------|----------------|-------------------------|------|-------|
|      | Piston Engine  | Turbo-Prop<br>(Percent) | Jets |       |
| 1950 | 100.0          | 0.0                     | 0.0  | 100   |
| 1951 | 100.0          | 0.0                     | 0.0  | 100   |
| 1952 | 100.0          | 0.0                     | 0.0  | 100   |
| 1953 | 100.0          | 0.0                     | 0.0  | 100   |
| 1954 | 99.1           | 0.9                     | 0.0  | 100   |
| 1955 | 97.4           | 2.6                     | 0.0  | 100   |
| 1956 | 95.9           | 4.1                     | 0.0  | 100   |
| 1957 | 94.0           | 6.0                     | 0.0  | 100   |
| 1958 | 90.5           | 9.2                     | 0.3  | 100   |
| 1959 | 84.0           | 13.3                    | 2.7  | 100   |
| 1960 | 77.9           | 14.4                    | 7.7  | 100   |
| 1961 | 71.6           | 16.5                    | 11.9 | 100   |
| 1962 | 68.1           | 17.2                    | 14.7 | 100   |
| 1963 | 65.9           | 17.6                    | 16.5 | 100   |
| 1964 | 63.4           | 17.4                    | 19.2 | 100   |
| 1965 | 58.7           | 17.8                    | 23.5 | 100   |
| 1966 | 51.1           | 19.7                    | 29.2 | 100   |
| 1967 | 42.8           | 21.3                    | 35.9 | 100   |
| 1968 | 35.8           | 20.5                    | 43.7 | 100   |
| 1969 | 29.9           | 20.9                    | 49.2 | 100   |
| 1970 | 27.3           | 21.0                    | 51.7 | 100   |
| 1971 | 24.6           | 21.0                    | 54.4 | 100   |
| 1972 | 22.4           | 20.9                    | 56.7 | 100   |
| 1973 | 20.3           | 20.2                    | 59.5 | 100   |
| 1974 | 19.1           | 19.2                    | 61.7 | 100   |
| 1975 | 17.9           | 18.6                    | 63.5 | 100   |
| 1976 | 17.0           | 18.2                    | 64.8 | 100   |
| 1977 | 16.2           | 17.7                    | 66.1 | 100   |
| 1978 | 15.1           | 16.9                    | 68.0 | 100   |
| 1979 | 14.3           | 16.3                    | 69.4 | 100   |
| 1980 | 13.6           | 15.7                    | 70.7 | 100   |

Source: Computed from Table II-1.

TABLE II-3

TOTAL AND HOURLY RATE OF OUTPUT, INTERNATIONAL  
SCHEDULED AIRLINES,\* ICAO CONTRACTING STATES,  
1950 - 1980.

| Year | Total Output<br>(Millions of TKA <sup>+</sup> ) | Aircraft Hours Flown<br>(Thousands) | TKA <sup>+</sup> /Hr. |
|------|-------------------------------------------------|-------------------------------------|-----------------------|
| 1950 | 6500                                            | 3901                                | 1637                  |
| 1951 | 6960                                            | 4183                                | 1664                  |
| 1952 | 7580                                            | 4478                                | 1693                  |
| 1953 | 8350                                            | 4502                                | 1855                  |
| 1954 | 9380                                            | 4539                                | 2066                  |
| 1955 | 10480                                           | 4811                                | 2178                  |
| 1956 | 11640                                           | 5123                                | 2272                  |
| 1957 | 13150                                           | 5588                                | 2353                  |
| 1958 | 14920                                           | 5950                                | 2508                  |
| 1959 | 17630                                           | 6023                                | 2927                  |
| 1960 | 22320                                           | 6184                                | 3609                  |
| 1961 | 26070                                           | 6258                                | 4166                  |
| 1962 | 29720                                           | 6347                                | 4683                  |
| 1963 | 33550                                           | 6478                                | 5179                  |
| 1964 | 38640                                           | 6787                                | 5693                  |
| 1965 | 45370                                           | 7367                                | 6158                  |
| 1966 | 52020                                           | 7889                                | 6594                  |
| 1967 | 64290                                           | 9325                                | 6894                  |
| 1968 | 79320                                           | 10122                               | 7836                  |
| 1969 | 90970                                           | 10796                               | 8426                  |
| 1970 | 100470                                          | 11175                               | 8991                  |
| 1971 | 109570                                          | 11389                               | 9621                  |
| 1972 | 117840                                          | 11563                               | 10191                 |
| 1973 | 129800                                          | 11990                               | 10826                 |
| 1974 | 133540                                          | 11870                               | 11250                 |
| 1975 | 141460                                          | 11910                               | 11877                 |
| 1976 | 152020                                          | 12077                               | 12588                 |
| 1977 | 162410                                          | 12500                               | 12993                 |
| 1978 | 174220                                          | 13032                               | 13369                 |
| 1979 | 189500                                          | 13270                               | 14280                 |
| 1980 | 199430                                          | 13550                               | 14718                 |

Source: Based on data provided by International Civil Aviation Organization, A Review of the Economic Situation of Air Transport, Circulars 73-AT/10; 105-AT/26; 122-AT/32 and 158-AT/57; The Economic Implications of the Introduction Into Service of Long-Range Jet Aircraft, Doc. 7894 - C/907.

\*Including their domestic operations.

+Tonne-Kilometres Available.

TABLE II-4

JET AIRCRAFT TYPES AND YEAR OF FIRST ENTRY INTO SERVICE  
INTERNATIONAL SCHEDULED AIRLINES, ICAO CONTRACTING  
STATES,\* 1980.

| Aircraft Types             | Year of First<br>Entry Into<br>Service | Number in<br>Service<br>1979 |
|----------------------------|----------------------------------------|------------------------------|
| BAC HS-106 Comet 4         | 1958                                   | 15                           |
| Boeing 707 (all Series)    | 1958                                   | 520                          |
| Douglas DC-8 (all Series)  | 1959                                   | 390                          |
| SUD SE-210 Caravelle       | 1959                                   | 130                          |
| Boeing 720                 | 1960                                   | 90                           |
| Convair CV 880             | 1960                                   | 10                           |
| Convair CV 990             | 1961                                   | 6                            |
| BAC HS-121 Trident         | 1963                                   | 55                           |
| Boeing 727                 | 1963                                   | 1460                         |
| BAC VC-10/Super VC-10      | 1964                                   | 19                           |
| BAC HS-125                 | 1964                                   | 35                           |
| BAC (Bac) One-Eleven       | 1965                                   | 150                          |
| Dassault-Mystere 20/Falcon | 1965                                   | 70                           |
| Douglas DC-9               | 1965                                   | 830                          |
| Boeing 737                 | 1967                                   | 525                          |
| Tupolev TU-134             | 1967                                   | 52                           |
| Ilyushin IL-62             | 1968                                   | 30                           |
| Boeing 747                 | 1969                                   | 380                          |
| Yakovlev YAK-40            | 1969                                   | 42                           |
| Fokker F-28 Fellowship     | 1969                                   | 95                           |
| Douglas DC-10              | 1971                                   | 291                          |
| Tupolev TU-154             | 1971                                   | 26                           |
| Lockheed L-1011            | 1972                                   | 164                          |
| Airbus A-300               | 1974                                   | 76                           |
| Marcel Dassault Mercure    | 1974                                   | 10                           |
| Fokker VFW 614             | 1975                                   | 5                            |
| BAC-Concorde               | 1976                                   | 11                           |
| Ilyushin IL-76             | 1977                                   | 4                            |

Source: International Civil Aviation Organization, A Review of the Economic Situation of Air Transport 1969 - 1979, Circular 158-AT/57, 1980, p. 52.

consistently enjoyed the widest ownership by airlines of any one jet aircraft type. The apparent tapering-off of the jet revolution, the corresponding productivity changes and their implications will be explored further later in this study.

The rise in productivity associated with jet technology is attributed to changes in such aircraft characteristics as speed, average payload, utilization rates and range. The average size or payload capacity of aircraft measured in tonnes increased constantly over the years, and by 1980 was 22.3 tonnes or approximately 3.6 times larger than it was when jets were first introduced into service in 1958 (Table II-5). This was the largest increase in any of the dimensions of aircraft investigated by this study. Stage distance similarly increased steadily to reach an average of 823 kilometres in 1980 which was 88.76 percent longer than the average distance in 1958. Between 1958 and 1980 the average block speed for the industry increased by 75.71 percent from approximately 350 to 615 kilometres per hour, while the utilization rate of aircraft increased 51.21 percent from an average of 4.1 to 6.2 hours per day, (Table II-5).

Increases in these technological features of aircraft (particularly payload capacity and speed) translate into increases in volume of output per aircraft and per unit of time. Given the size (payload capacity) of an aircraft, the higher its speed the more output (tonne-kilometres available) it can generate per unit of time. Similarly, for a given speed, the larger the size of aircraft the larger will be the output per unit of time. It follows therefore that as aircraft become larger and faster productivity (TKA/Hr.) will tend to rise. Such has been the experience of the air transport industry with the use of jet technology.

The average increases in the dimensions of aircraft and the resulting gains indicated above are even more outstanding when comparisons are made on the basis of individual aircraft types. Table II-6 and Figure II-1 exemplify such comparisons when aircraft size (payload capacity) and speed are combined to give tonne-kilometres available per hour. The sharp increase in speed and resultant

TABLE II-5

SOME DIMENSIONS OF AIRCRAFT PRODUCTIVITY,  
INTERNATIONAL SCHEDULED AIRLINES,\* ICAO  
CONTRACTING STATES, 1958 - 1980.

| Year | Size<br>(Tonnes) | Productivity Factors <sup>a</sup> |                                |                              |
|------|------------------|-----------------------------------|--------------------------------|------------------------------|
|      |                  | Speed<br>Kilometres<br>(Per Hour) | Utilization<br>(Hours Per Day) | Stage Length<br>(Kilometres) |
| 1958 | 6.2              | 350                               | 4.1                            | 436                          |
| 1959 | 6.5              | 356                               | 4.6                            | 458                          |
| 1960 | 7.2              | 362                               | 5.2                            | 470                          |
| 1961 | 8.3              | 392                               | 4.9                            | 474                          |
| 1962 | 9.2              | 418                               | 4.9                            | 490                          |
| 1963 | 9.8              | 436                               | 5.2                            | 512                          |
| 1964 | 10.5             | 448                               | 5.2                            | 522                          |
| 1965 | 11.1             | 469                               | 5.3                            | 548                          |
| 1966 | 11.6             | 483                               | 6.1                            | 573                          |
| 1967 | 12.2             | 518                               | 6.7                            | 616                          |
| 1968 | 13.0             | 548                               | 6.8                            | 663                          |
| 1969 | 13.9             | 570                               | 6.9                            | 707                          |
| 1970 | 14.3             | 582                               | 6.5                            | 739                          |
| 1971 | 15.5             | 587                               | 6.8                            | 738                          |
| 1972 | 16.3             | 591                               | 6.7                            | 747                          |
| 1973 | 17.3             | 591                               | 6.8                            | 760                          |
| 1974 | 18.1             | 591                               | 6.4                            | 767                          |
| 1975 | 18.8             | 597                               | 6.2                            | 776                          |
| 1976 | 19.4             | 602                               | 6.1                            | 785                          |
| 1977 | 20.1             | 606                               | 6.2                            | 800                          |
| 1978 | 20.5             | 608                               | 6.3                            | 819                          |
| 1979 | 21.5             | 611                               | 6.2                            | 819                          |
| 1980 | 22.3             | 615                               | 6.2                            | 823                          |

Source: International Civil Aviation Organization, A Review of the Economic Situation of Air Transport, Circular 105-AT/26, Circular 122-AT/32 and Circular 158-AT/57.

\*Including their domestic operations.

<sup>a</sup>These figures are industry averages for different aircraft types.

productivity can be observed starting with the CV-880 and continuing with the other jet aircraft included in the comparison. On the average these jets have 2.9 times the speed and 3.3 times the payload capacity, but almost 9 times the productivity of piston and turbo-prop aircraft with which they were compared (Table II-6). The dimensions of aircraft are discussed further below where their implications for cost of production are investigated.

### Productivity and Unit Cost

Before examining the evidence with respect to the relationship between productivity and cost in the airline industry, that linkage can be explained with the help of a brief review of familiar theory. A firm's supply decision is based on the relationship between cost and output. Cost behaves in a way that is determined by the underlying production function; hence there is a link between production function and the cost function. They are essentially two sides of the same concern to the firm. That is, when viewed from the standpoint of the production function, this concern is with getting the maximum output from given inputs. Alternatively, the same concern can be interpreted in terms of the cost function in which case the focus is on attaining the minimum cost of producing a given output.

This relationship indicates that a rise in the average productivity of inputs will be reflected in a fall in the average (unit) cost of producing the output, and vice versa. A simple and familiar example illustrates the relationship between the production function and the cost function. Assuming a production function of the form:  $X = f(G, H)$  and cost of production represented by  $C = G(P_g) + H(P_h)$  it can be shown<sup>2</sup> that:

$$C/X = ATC = P_g/AP_G + P_h/AP_H$$

$$\text{and } dC/dX = MC = P_h/MP_H.$$

TABLE II-6

AVERAGE HOURLY PRODUCTIVITY OF SELECTED AIRCRAFT  
IN UNITED STATES DOMESTIC AIRLINE SERVICE, 1980.

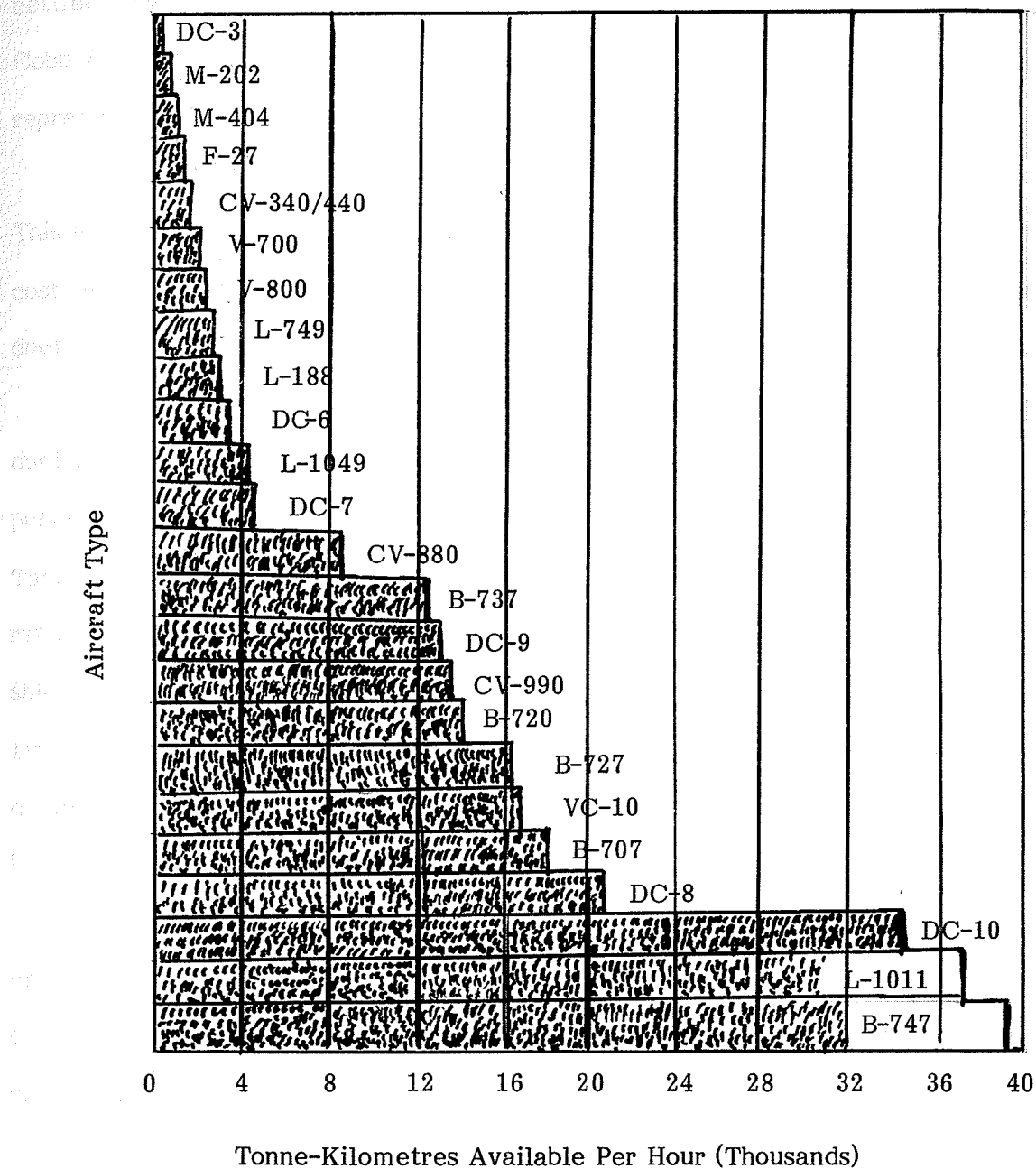
| Aircraft   | Payload Capacity<br>(Tonnes) | Speed<br>(Kilometres)<br>(Per Hour) | Tonne-Kilometres<br>Available Per Hour |
|------------|------------------------------|-------------------------------------|----------------------------------------|
| DC-3       | 3.47                         | 186                                 | 645.4                                  |
| M-202      | 3.47                         | 216                                 | 749.5                                  |
| M-404      | 4.63                         | 221                                 | 1023.2                                 |
| F-27       | 4.63                         | 280                                 | 1296.4                                 |
| CV-340/440 | 5.20                         | 312                                 | 1622.4                                 |
| V-700      | 6.36                         | 312                                 | 1984.3                                 |
| V-800      | 7.52                         | 312                                 | 2346.2                                 |
| L-749      | 8.67                         | 344                                 | 2982.5                                 |
| L-188      | 10.18                        | 307                                 | 3125.3                                 |
| DC-6       | 9.83                         | 392                                 | 3853.4                                 |
| L-1049     | 9.83                         | 424                                 | 4167.9                                 |
| DC-7       | 10.41                        | 432                                 | 4497.1                                 |
| CV-880     | 12.41                        | 744                                 | 9032.2                                 |
| B-737      | 13.88                        | 917                                 | 12728.0                                |
| DC-9       | 14.46                        | 903                                 | 13057.4                                |
| CV-990     | 13.99                        | 1006                                | 14073.9                                |
| B-720      | 16.19                        | 871                                 | 14101.5                                |
| B-727      | 18.85                        | 914                                 | 17228.9                                |
| VC-10      | 19.66                        | 885                                 | 17399.1                                |
| B-707      | 20.80                        | 885                                 | 18408.0                                |
| DC-8       | 21.97                        | 965                                 | 21201.1                                |
| DC-10      | 35.50                        | 965                                 | 34257.5                                |
| L-1011     | 39.90                        | 938                                 | 37426.2                                |
| B-747      | 49.15                        | 803                                 | 39467.5                                |

Source: Appendix Tables B-12 and B-13.



FIGURE II-1

AVERAGE HOURLY PRODUCTIVITY OF SELECTED AIRCRAFT  
IN THE UNITED STATES DOMESTIC AIRLINE SERVICE, 1980.



Source: Table II-6.

Thus given the input prices,<sup>3</sup> the average and marginal costs of the output are inversely related to the average and marginal products of the variable input respectively.

In terms of total (as opposed to partial) productivity, a similar relationship between the production function and cost of production can be derived. Assuming a Cobb-Douglas production function of the form:  $X = AK^a N^b$ , and cost of production represented by:  $C = K(P_K) + N(P_N)$ , it can be shown<sup>4</sup> that:

$$C/X = ATC = (P_K)^a (P_N)^b / Aa^a(b)^b$$

This equation indicates that for given factor prices and factor shares,<sup>5</sup> the average cost of the output ( $C/X$ ) is inversely related to the measure of total factor productivity ( $A$ ).

These product-cost relationships therefore suggest that the growth of productivity that has accompanied the change in technology (jet revolution) has important implications for unit operating cost. Examination of the data presented in Table II-7 and Figure II-2 reveals that the evidence is consistent with the theoretical relationships discussed above. That is, the data shows an inverse relationship between productivity and unit cost. It will be observed that since the early 1970's the trend in unit operating cost measured in both current and constant dollars has been reversed. This change in the pattern of costs will be further investigated later.

The observed decline in unit operating cost is accounted for by the economies of scale associated with the various dimensions of aircraft noted above. These dimensions will now be investigated further with respect to each one's cost-related properties. Their combined effect on cost will also be examined with the help of regression analysis.

With jet technology have come larger sizes of aircraft which have the following cost-related features:<sup>6</sup>

TABLE II-7

AIRCRAFT HOURLY PRODUCTIVITY AND UNIT OPERATING  
COSTS COMPARISON OF TRENDS, INTERNATIONAL  
SCHEDULED AIRLINES\*, 1950 - 1980.

| Year | Average Hourly<br>Productivity<br>(TKA+/Hr.) | Unit Operating Costs<br>(U.S. Cents per TKA+)<br>(Current Dollars) | Unit Operating Costs<br>(U.S. Cents per TKA+)<br>(Constant 1967 Dollars) |
|------|----------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------------|
| 1950 | 1637                                         | 28.93                                                              | 40.12                                                                    |
| 1951 | 1664                                         | 28.48                                                              | 36.61                                                                    |
| 1952 | 1693                                         | 28.70                                                              | 36.10                                                                    |
| 1953 | 1855                                         | 28.02                                                              | 34.98                                                                    |
| 1954 | 2066                                         | 27.12                                                              | 33.69                                                                    |
| 1955 | 2178                                         | 26.78                                                              | 33.81                                                                    |
| 1956 | 2272                                         | 27.12                                                              | 32.90                                                                    |
| 1957 | 2353                                         | 26.67                                                              | 31.64                                                                    |
| 1958 | 2508                                         | 26.10                                                              | 30.14                                                                    |
| 1959 | 2927                                         | 26.22                                                              | 30.03                                                                    |
| 1960 | 3609                                         | 25.88                                                              | 29.18                                                                    |
| 1961 | 4166                                         | 24.18                                                              | 26.97                                                                    |
| 1962 | 4683                                         | 22.83                                                              | 25.20                                                                    |
| 1963 | 5179                                         | 21.70                                                              | 23.66                                                                    |
| 1964 | 5693                                         | 20.57                                                              | 22.14                                                                    |
| 1965 | 6158                                         | 19.78                                                              | 20.93                                                                    |
| 1966 | 6594                                         | 19.32                                                              | 19.88                                                                    |
| 1967 | 6894                                         | 18.31                                                              | 18.31                                                                    |
| 1968 | 7836                                         | 17.63                                                              | 16.92                                                                    |
| 1969 | 8426                                         | 15.40                                                              | 14.03                                                                    |
| 1970 | 8991                                         | 16.20                                                              | 13.93                                                                    |
| 1971 | 9621                                         | 16.90                                                              | 13.93                                                                    |
| 1972 | 10191                                        | 17.60                                                              | 14.05                                                                    |
| 1973 | 10826                                        | 18.90                                                              | 14.20                                                                    |
| 1974 | 11250                                        | 22.70                                                              | 15.37                                                                    |
| 1975 | 11877                                        | 24.90                                                              | 15.45                                                                    |
| 1976 | 12588                                        | 25.20                                                              | 14.78                                                                    |
| 1977 | 12993                                        | 27.50                                                              | 15.15                                                                    |
| 1978 | 13369                                        | 30.10                                                              | 15.40                                                                    |
| 1979 | 14280                                        | 35.10                                                              | 16.15                                                                    |
| 1980 | 14718                                        | 39.90                                                              | 16.18                                                                    |

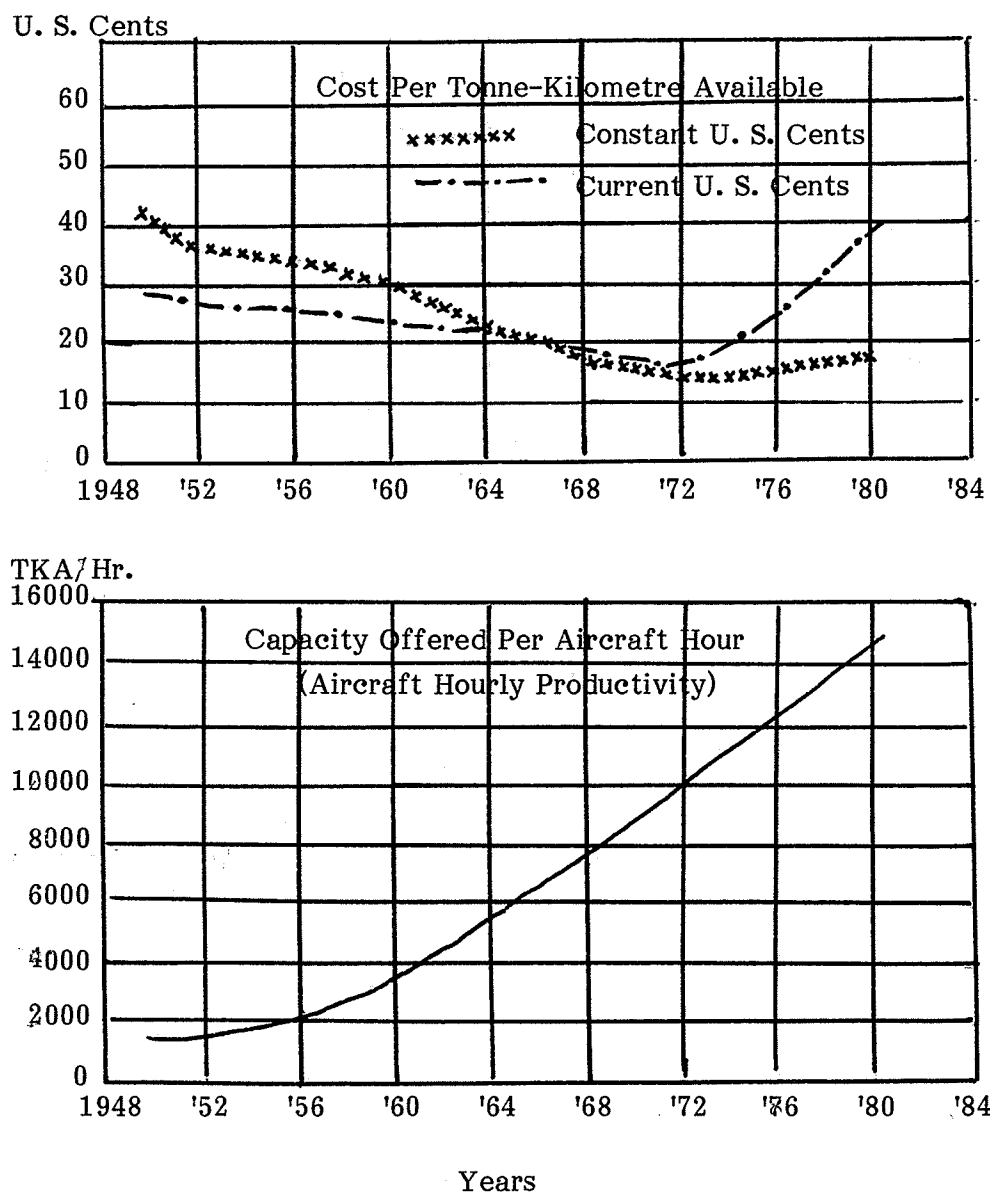
Source: Computed from International Civil Aviation Organization, A Review of the Economic Situation of Air Transport, Circular 105-AT/26, 1971, p. 30; Circular 122-AT/32, 1974, p. 57; Circular 133-AT/40, 1977, pp. 51 and 67; and Circular 158-AT/57, 1980, pp. 54 and 64.

\*Including their domestic operations.

+Tonne-Kilometres Available.

FIGURE II-2

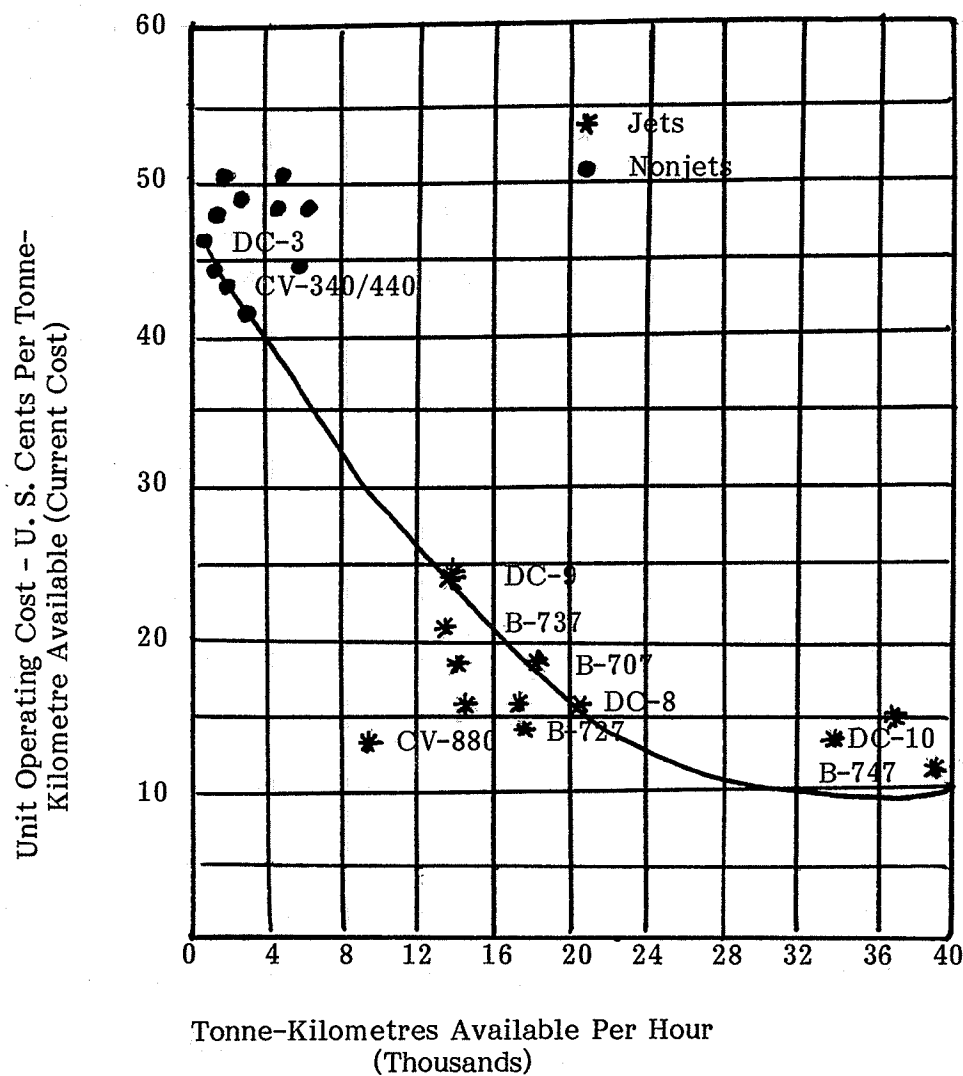
UNIT OPERATING COSTS AND AIRCRAFT HOURLY  
PRODUCTIVITY COMPARISON TRENDS, INTER-  
NATIONAL SCHEDULED AIRLINES, 1950 -1980.



Source: Table II-7.

FIGURE II-3

HOURLY PRODUCTIVITY OF SELECTED AIRCRAFT TYPES  
RELATED TO UNIT OPERATING COST, UNITED STATES  
DOMESTIC AIRLINE SERVICE, 1980.



Source: Table II-6 and Appendix Table B-12 and B-13.

- (a) The larger scale gives aerodynamic advantages and lower proportionate drag.
- (b) The structural weight is a lower percentage of total weight.
- (c) The operation weight (crew, radio, navigational equipment, etc.) is a smaller percentage of the total weight.
- (d) Larger engines may be used which are more efficient both in terms of horse power per pound of engine weight and horse power per gallon of fuel.
- (e) The cost of aircrew salaries and expenses remains more or less fixed and becomes a smaller percentage of the total costs.

To these features of size one should add the more obvious dimension of larger seating and total tonnage capacity with its related payload potential. Not only has the seating capacity of jets been increased relative to that of piston and turbo-prop aircraft, but within the jet generation itself the tendency towards larger capacity is evidenced. For instance, the fuselage of the DC-8 and the Boeing 727 has been "stretched" or lengthened to accomodate more passengers. In the case of the DC-8, this stretching has resulted in an additional thirty feet of fuselage and sixty seats of tourist class. The stretched versions of these two aircraft have been estimated to produce at least a ten percent reduction in unit operating cost below that of the original versions.<sup>7</sup> Even larger cost reductions are associated with the Boeing 747 (jumbo jet) whose seating capacity of over four hundred has the potential to reduce unit cost by as much as twenty-five percent below that of the DC-8 and the Boeing 727.<sup>8</sup>

Jet aircraft have not only become larger but have at the same time become faster (see Table II-8). Higher speeds save time and therefore contribute to a reduction in airline costs. For example, the work required of the crew and cabin staff, and the wages they are paid bear a direct relationship to a ramp-to-ramp



time which becomes relatively short as speed increases. Note for example that the flying time between Montreal and Kingston, Jamaica is reduced by approximately three and one half hours or 40.7 percent when speed increases by 68.8 percent from 362 to 611 kilometres per hour, (Table II-8). Besides wages, meals and other in-flight "services" cost less as speed increases and travel time is reduced.<sup>9</sup>

Another cost-reducing feature of jet technology is the utilization rate of its equipment. The jet aircraft is capable of being more efficiently scheduled than its piston-engine counterpart, because it requires less frequent maintenance and overhaul, and can therefore achieve a higher rate of utilization. Thus on the average jets fly about 6,000 hours or twice as long as piston-engine aircraft before engine overhaul is required, and this has given rise to potential daily utilization rates of about 7.5 hours for the former compared to approximately 5 hours for the latter.<sup>10</sup>

Utilization rates have important implications for costs. Rapid technological change means that the depreciation and obsolescence of aircraft are more a function of time than use. Thus high utilization rates will help to offset the cost of depreciation and obsolescence. Higher utilization rates also promote a lower unit operating cost in the case where certain direct operating costs are "fixed" in nature. For instance, some maintenance staff and facilities must be maintained regardless of how much they and the aircraft are used. Therefore, unit operating cost will be reduced as higher utilization rates help to spread these "fixed" costs over a larger "output" of air transport service. Additionally, jet technology permits more efficient scheduling and utilization of crew and other personnel, thereby reducing the relative cost of these inputs per unit of time as explained above.

Average stage length or distance is another crucial element in the economic performance and the related operating cost of aircraft. As Cherington concluded, "the principal determinant of airline costs appears to be length of haul coupled with sufficient volume of traffic to permit a relatively long average length of hop."<sup>11</sup>

TABLE II-8

SOME FLEET, PERSONNEL AND PRODUCTION DEVELOPMENTS:  
INTERNATIONAL SCHEDULED AIRLINES,\* ICAO  
CONTRACTING STATES, 1960 - 1979.<sup>x</sup>

| Item                                             | Year   |        | Percent  |
|--------------------------------------------------|--------|--------|----------|
|                                                  | 1960   | 1979   | Increase |
| 1. Number of Airlines                            | 161    | 234    | 45.3     |
| 2. Number of Aircraft <sup>a</sup>               | 3730   | 5860   | 57.1     |
| 3. Number of Employees                           | 403300 | 980000 | 143.0    |
| 4. Aircraft Hours Flown (Thous.)                 | 6184   | 13270  | 114.6    |
| 5. Tonne-Kilometres Available (Mill.)            | 22320  | 189500 | 749.0    |
| 6. Average Stage Distance (Kilometres)           | 470    | 819    | 74.3     |
| 7. Average Speed (Kilometres/Hour)               | 362    | 611    | 68.8     |
| 8. Average Payload Capacity (Tonnes)             | 7.2    | 21.5   | 198.6    |
| 9. Total Employee Per Aircraft (3÷2)             | 108    | 167    | 54.6     |
| 10. Hours Flown Per Aircraft (4÷2)               | 1658   | 2265   | 36.6     |
| 11. TKA <sup>b</sup> Per Aircraft Hour (5÷4)     | 3609   | 14280  | 295.7    |
| 12. TKA <sup>b</sup> Per Aircraft (5÷2) (Mill.)  | 6      | 32     | 433.3    |
| 13. TKA <sup>b</sup> Per Employee (5÷3) (Thous.) | 55     | 193    | 250.9    |

Source: International Civil Aviation Organization, A Review of the Economic Situation of Air Transport, Circulars 122-AT/32, 1974, pp. 55-57; 105-AT/26, 1971, pp. 27-30; 133-AT/40, 1977, pp. 51-52; and 158-AT/57, 1980, pp. 54-55.

\*Including their domestic operations.

<sup>x</sup>This was the most recent year for which data on all the items included in the table were available.

<sup>a</sup>Over 9 Tonnes maximum take-off weight.

<sup>b</sup>Tonne-Kilometres available.



In a similar vein, Lansing<sup>12</sup> argued that there is a tendency for operating cost per mile to decline as the stage length increases. Table II-9 provides some relevant details.

Some stage lengths impose limits on the type and operating costs of the aircraft used. Thus if circumstances (example traffic density) warrant nonstop long distance flights, only aircraft so equipped can be used. Jets are more capable of such flights than piston or turbo-prop aircraft, and are therefore better able to exploit the cost reduction associated with greater stage lengths as explained below.

Whether stage lengths are short or long, a relatively fixed cost must be incurred for taking off and landing. Therefore, as the stage length increases, the time and fuel spent in taxiing, taking off, climbing and descending represent a smaller proportion of the operating cost of the flight. The economies of scale (distance) implied here can further be extended to crew cost which is also relatively insensitive<sup>13</sup> to stage lengths, and is therefore more economically justifiable (from the airlines' viewpoint) the greater the stage length. Moreover, as distance increases, operating speed tends to become more efficient with the attainment of higher flying altitudes and consequently reduced weight which contributes to lower operating costs. Over short hauls, the time in the air does not permit the aircraft to attain its full cruising altitude, and thus the maximum cruising speed may be relatively useless.

These factors are responsible for the observed<sup>14</sup> declining portion of the average cost curve of aircraft operation. However, there are limits to the stage length over which direct operating costs will decline, because beyond a certain point in distance, it will be necessary to replace some of the payload with fuel, and the greater the increase in distance beyond this point, the more fuel must be substituted for payload. Thus beyond some stage length, it will be uneconomical for the aircraft to operate.

TABLE II-9

RELATIONSHIP BETWEEN STAGE LENGTH AND DIRECT  
OPERATING COSTS FOR SELECTED AIRCRAFT, 1980.

| Stage Length    | Operating Costs                            |                    |         |                    |                    |
|-----------------|--------------------------------------------|--------------------|---------|--------------------|--------------------|
|                 | Boeing<br>727                              | Boeing<br>720/720B | Electra | Douglas<br>DC-7/7B | Douglas<br>DC-6/6B |
|                 | (U.S. cents per tonne-kilometre available) |                    |         |                    |                    |
| 250 Kilometres  | 42.12                                      | 51.36              | 39.23   | 51.20              | 44.30              |
| 500 Kilometres  | 29.84                                      | 31.46              | 34.53   | 42.68              | 39.78              |
| 750 Kilometres  | 26.94                                      | 26.39              | 32.73   | 41.04              | 38.14              |
| 1000 Kilometres | 25.31                                      | 24.23              |         |                    |                    |
| 1500 Kilometres | 22.96                                      | 21.88              |         |                    |                    |

Source: International Civil Aviation Organization, A Review of the Economic Situation of Air Transport, Circular 158-AT/57, 1980; Federal Aviation Agency, Direct Operating Costs and Other Performance Characteristics of Transport Aircraft in Airline Service, 1979; Mahlon R. Straszheim, The International Airline Industry, The Brookings Institution, Washington, D. C. 1969, p. 74.

The cost pattern described above will give rise to conventional U-shaped average cost curves in the direct operation of different aircraft types. However, the point (stage length) at which this curve begins to turn upwards will vary with the type of aircraft. In general, jets are designed for longer stage lengths than earlier aircraft types which means that the cost curves of the former are likely to be still declining when those of latter have already begun to rise. Given the traffic density, airlines may therefore find it more economical to operate a jet aircraft from say New York City to Jamaica nonstop, than to operate another type of aircraft which by design requires an intermediate stop such as at Miami for refueling and similar purpose. This nonstop feature of the aircraft further has implications for traffic generation as will be seen later.

North American-Jamaican routes involve stage lengths long enough<sup>15</sup> for the realization of economies of distance, yet not so long as to warrant the fuel-payload tradeoff indicated above. Thus airlines are in a relatively good position to exploit operating cost reductions on these routes through the use of jet equipment which in fact characterizes airline operation to and from Jamaica.<sup>16</sup> This is not to imply that the predominant use of jet aircraft on these routes can solely be attributed to stage lengths with their associated operating cost patterns. It is recognized that such other factors as the competitive dictates of the technological revolution in the industry play a role in the choice of aircraft employed.

The relationship between cost and the productivity factors discussed above was further explored by this study with the help of multiple regression analysis. From the data presented in Appendix Tables B-12 and B-13 the results<sup>17</sup> were:

$$\log C_o = 2.8276 - 0.3053 \log S_t - 0.3385 \log S_z$$

(2.3111)
(2.3855)

$$- 0.0897 \log S_p - 0.2326 \log U_t$$

(2.8741)
(0.2408)

$$R^2 = 0.8986$$

(the numbers in parentheses are t statistics).

where:

- Co = operating cost per tonne-kilometre available.
- St = stage length, measured in kilometres.
- Sz = size of aircraft, measured by tonnes of payload.
- Sp = speed of aircraft, measured in kilometres per hour.
- Ut = utilization, measured in hours per day.

These results support the earlier argument that operating cost is inversely related to the independent variables included in the analysis. (Note that the coefficients of these variables all have the appropriate sign). Test of the regression results shows that  $R^2$  is significant at the 5 percent level, thereby indicating that the explanatory variables have been correctly identified. Further support is provided by the t-test which shows the stage length, size and speed variables to be significant at the 5 percent level.

While these economies of size, speed, utilization, and distance (discussed above) have contributed to the downward trend in cost shown earlier, there have been some forces which have tended to offset that trend in recent years. Firstly, wages and salaries in the industry have been increasing at faster rates than national averages. Since 1969 these rates have averaged about 18 percent annually for non-United States airlines and more than 11 percent for United States airlines.<sup>18</sup> These wage increases have outstripped productivity<sup>19</sup> increases in the industry and have therefore imposed inflationary pressure on the industry.

Another factor contributing to the upward trend in unit costs is aircraft fuel. For the industry as a whole the price of fuel decreased at an annual rate of about 5 percent throughout the decade of the 1960's, then levelled off for the first three years in the 1970's.<sup>20</sup> Between 1973 and 1974 fuel cost increased sharply (86.95 percent) presumably as a result of the so-called "energy crisis." This sudden jump produced an elevated level of fuel cost which has since then been sustained, and in

fact has continued to rise though at a much more moderate rate of approximately 6.7 percent annually.

As a consequence, fuel cost became the single most important component of airline operating costs. Of eleven cost categories reported by the International Civil Aviation Organization, fuel cost has, since 1974, continued to be the single largest contributor to those costs. Prior to 1974 fuel ranked fourth as a cost contributor behind the categories ticketing, sales and promotion; maintenance and overhaul; and station expenses.<sup>21</sup> Table II-10 provides some further details with respect to fuel cost.

Thirdly, the industry has been experiencing substantial increases in user charges, including landing and departure fees. During the last decade these charges have been increasing at an average annual rate of about 20 percent.<sup>22</sup>

A fourth contributor to the upward trend in airline costs is related to the environmental issues of pollution control and noise abatement which have been receiving increased public attention in recent years. Such environmental improvements necessitate large expenses by the airlines. For instance, in 1970 it was estimated<sup>23</sup> that United States airlines had committed more than \$1 billion to such purposes, an amount which was as large as the entire payroll of the United States airlines only 10 years earlier.

#### Implications for Tourist Traffic Growth

From the observations on productivity and operating costs, the implications for fares and traffic growth can now be sought. The level of air transport operating costs is of fundamental importance to the economy of the air transport industry. On the one hand, airline firms will in general seek to establish an average revenue rate (fare level) that is high enough to cover costs, and if possible produce some margin of profit, unless they are subsidized. On the other hand, the airlines' interest in stimulating traffic growth will tend to prevent the average revenue rate

TABLE II-10

FUEL COST AS A PERCENTAGE OF TOTAL OPERATING  
EXPENSES, INTERNATIONAL SCHEDULED AIRLINES,\*  
ICAO CONTRACTING STATES, 1969 - 1980.

| Year | Percent |
|------|---------|
| 1969 | 12.3    |
| 1970 | 11.2    |
| 1971 | 11.1    |
| 1972 | 11.0    |
| 1973 | 12.0    |
| 1974 | 19.1    |
| 1975 | 19.4    |
| 1976 | 19.3    |
| 1977 | 19.2    |
| 1978 | 18.4    |
| 1979 | 18.3    |
| 1980 | 19.5    |

Source: International Civil Aviation Organization, A Review of the Economic Situation of Air Transport 1969 - 1979, Circular 158-AT/57, p. 63;  
The Civil Aeronautics Board, Fuel Cost and Consumption, 1981, p. 7.

\*Including their domestic operations.

from rising too far above the level of costs; for given the price elastic character of the demand for air transportation (see next chapter), high fare levels will have a dampening effect on the growth of traffic. This would be particularly likely if air fares were set so high as to make relatively low-cost surface transport an attractive substitute.

Thus air transport operating costs have an important determining effect on the level of air fare and consequently on air traffic growth. Although the relationship between the two (i.e., operating costs and fare level) is somewhat distorted by the industry rate-making machinery to be discussed later, the evidence indicates that there is a direct relationship between the two. That is, the level of air fare (average revenue rate) tends to fall when operating costs fall, and to rise when operating costs rise (see Table II-11 and Figure II-4).

Using the data of Table II-11 some further indication of the relationship between operating cost and air fare is provided by the result of simple regression analysis. The following form of the regression equation was used.

$$\log F = b_0 + b_1 \log C$$

where F = average revenue per tonne-kilometre available.

C = unit operating cost per tonne-kilometre available.

The fitted equation is as follows:

$$\log F = -0.35 + 1.27 \log C$$

(t = 10.76)

$$R^2 = 0.891$$

Note that the earlier indication of a direct relationship between the two variables is supported by the positive sign of the coefficient of the independent variable; and also that changes in the level of average revenue (fare) appear to be quite sensitive to changes in the cost level. That is, the cost coefficient indicates that a one percent change in cost will certeris paribus induce a fare change of 1.27 percent in the same direction.



TABLE II-11  
UNIT OPERATING COSTS AND REVENUE, INTERNATIONAL  
SCHEDULED AIRLINES,\* 1960 - 1980.

| Year | Operating Costs & Revenue<br>Per TKA <sup>a</sup> |         | Operating Costs & Revenue<br>Per TKP <sup>b</sup> |         |
|------|---------------------------------------------------|---------|---------------------------------------------------|---------|
|      | Cost<br>(U.S. Cents)                              | Revenue | Cost<br>(U.S. Cents)                              | Revenue |
| 1960 | 25.88                                             | 33.90   | 45.88                                             | 46.22   |
| 1961 | 24.18                                             | 24.63   | 44.86                                             | 45.20   |
| 1962 | 22.83                                             | 23.62   | 43.05                                             | 44.97   |
| 1963 | 21.70                                             | 22.37   | 40.45                                             | 44.41   |
| 1964 | 20.57                                             | 22.04   | 37.86                                             | 42.12   |
| 1965 | 19.78                                             | 21.70   | 36.84                                             | 40.57   |
| 1966 | 19.32                                             | 20.91   | 35.14                                             | 39.44   |
| 1967 | 18.31                                             | 19.55   | 34.13                                             | 38.31   |
| 1968 | 17.63                                             | 18.87   | 33.22                                             | 37.06   |
| 1969 | 15.40                                             | 16.20   | 30.70                                             | 32.50   |
| 1970 | 16.20                                             | 16.70   | 32.90                                             | 33.80   |
| 1971 | 16.90                                             | 17.00   | 34.90                                             | 35.90   |
| 1972 | 17.60                                             | 18.20   | 35.30                                             | 36.50   |
| 1973 | 18.90                                             | 19.80   | 37.20                                             | 38.90   |
| 1974 | 22.70                                             | 23.36   | 43.70                                             | 44.70   |
| 1975 | 24.90                                             | 25.47   | 48.70                                             | 49.60   |
| 1976 | 25.20                                             | 26.50   | 47.80                                             | 50.30   |
| 1977 | 27.50                                             | 29.00   | 51.00                                             | 53.80   |
| 1978 | 30.10                                             | 31.80   | 52.90                                             | 55.90   |
| 1979 | 35.10                                             | 35.50   | 60.40                                             | 61.00   |
| 1980 | 39.90                                             | 40.72   | 64.55                                             | 65.12   |

Source: Computed from International Civil Aviation Organization, A Review of the Economic Situation of Air Transport, Circular 122-AT/32, 1974, p. 66, and Circular 105-AT/26, 1971, pp. 39-40, Circular 133-AT/40, 1977, p. 63; and Circular 158-AT/57, 1980, p. 64.

\*Including their domestic operations

<sup>a</sup>Tonne-Kilometres available.

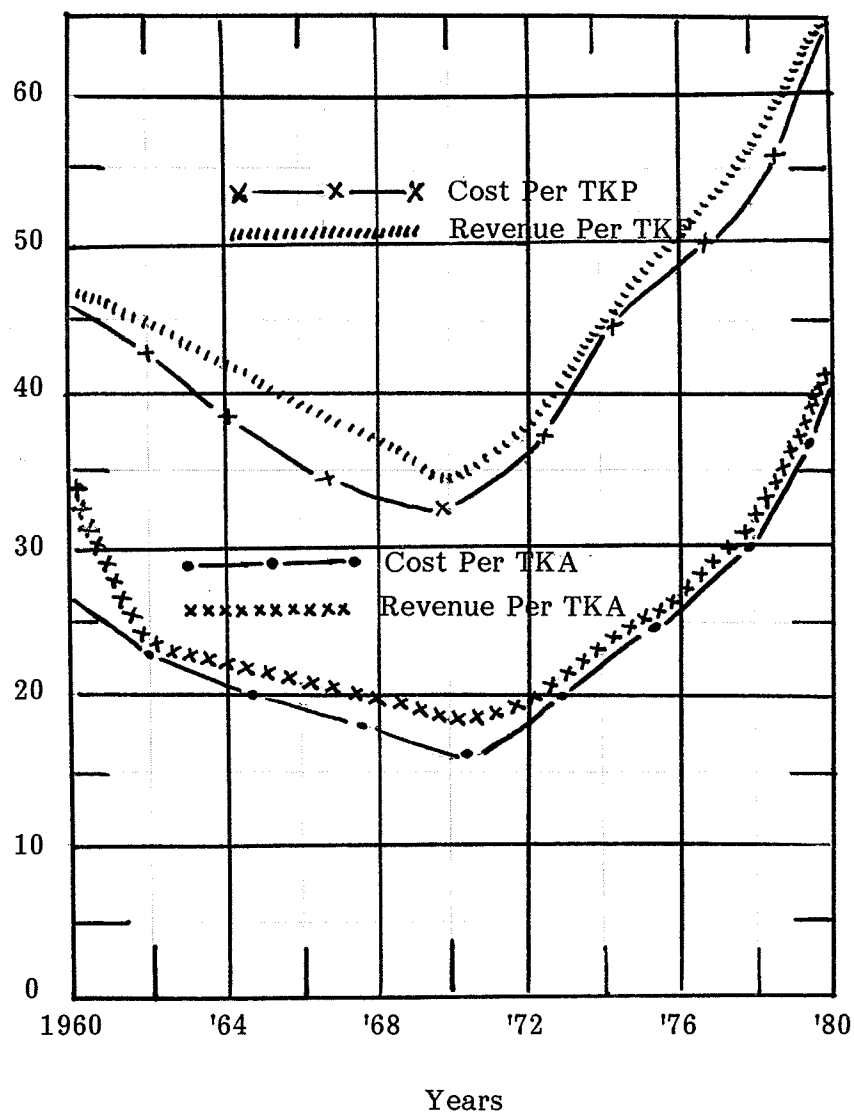
<sup>b</sup>Tonne-Kilometres performed.



FIGURE II-4

UNIT OPERATING COST AND REVENUE  
INTERNATIONAL SCHEDULED AIRLINES  
1950 - 1980

U. S.  
Cents



Source: Table II-11.

Furthermore, the relationship between the two and air traffic growth is circular. That is, a fall in operating costs tends to give rise to a reduction in air fare which stimulates traffic growth. But this growth in traffic through higher load factors, flight frequencies, and aircraft utilization tends to reduce unit operating cost<sup>24</sup> further, thereby inducing further reduction in fares, stimulating traffic growth and so on. Conversely, air traffic growth would be dampened in the case where rising operating costs lead to higher air fares, reduction in traffic volume, lower load factors, flight frequencies and aircraft utilization, all of which result in higher operating costs and so on in circular fashion.

The productivity analysis undertaken earlier in this chapter indicates that since the 1970's the momentum of the so-called jet revolution has subsided. Based on the preceding discussion of the productivity-cost-fare-traffic nexus, this deceleration of technological change in the airline industry suggests a similar impact on traffic growth. This matter will be further investigated with particular attention to Jamaican tourism in Chapters V and VI.

## CHAPTER II

## NOTES

1. Annual percentage rates are calculated in Appendix A.
2. The following definitions were employed in establishing the link between the production function and the cost of production:

|        |   |                                           |
|--------|---|-------------------------------------------|
| X      | = | units of output.                          |
| G      | = | units of fixed input.                     |
| H      | = | units of variable input.                  |
| ATC    | = | average total cost per unit of output.    |
| AVC    | = | average variable cost per unit of output. |
| MC     | = | marginal cost.                            |
| $AP_G$ | = | average productivity of G.                |
| $AP_H$ | = | average productivity of H.                |
| $MP_H$ | = | marginal productivity of H.               |
| $P_g$  | = | price per unit of G.                      |
| $P_h$  | = | price per unit of H.                      |

Given the above definitions, the following expressions can now be derived:

$$ATC = G(P_g)/X + H(P_h)/X$$

Equivalently,

$$ATC = \frac{P_g}{X/G} + \frac{P_h}{X/H}$$

Since  $X/G$  and  $X/H$  are the average products of G and H respectively, therefore,

$$ATC = P_g/AP_G + P_h/AP_H$$

Similarly,

$$MC = dP_h(H)/dX = P_h(dH/dX)$$

But since

$$MP_H = dX/dH$$

Therefore,

$$MC = P_h/MP_H$$

3. Constancy of input prices is not a necessary condition for these results. In the event of changing input prices the unit cost of output will depend on the relative change in these prices vis a vis the change in productivity. For example, if a relative rise in input prices is less than that of average productivity, average cost would still fall.

4. Cf. James V. Koch, Microeconomic Theory and Applications, Little, Brown and Company, Boston, 1976, footnote 9, p. 181. In deriving this product-cost relationship the following definitions were used:

|        |   |                                                                                                    |
|--------|---|----------------------------------------------------------------------------------------------------|
| X      | = | units of output.                                                                                   |
| K      | = | units of capital input.                                                                            |
| N      | = | units of labor input.                                                                              |
| A      | = | a measure of total factor productivity (changes in A represent shifts of the production function). |
| a      | = | capital's share of the value of output ( $a=1-b$ ).                                                |
| b      | = | labor's share of the value of output.                                                              |
| C      | = | short-run cost constraint of the firm.                                                             |
| $P_K$  | = | price per unit of K.                                                                               |
| $P_N$  | = | price per unit of N.                                                                               |
| $MP_K$ | = | marginal product of K.                                                                             |
| $MP_N$ | = | marginal product of N.                                                                             |

Given the production function:  $X = AK^a N^b$  and the cost constraint:  $C = K(P_K) + N(P_N)$  the least cost combinations of inputs along the expansion path is found by applying the principle of substitution:

$$-dK/dN = MP_N/MP_K = P_N/P_K$$

$$(b/a) (K/N) = P_N/P_K$$

$$(a) N(P_N) - (b) K(P_K) = 0 \quad (3)$$

Solving equations (2) and (3) simultaneously for K and N:

$$K = (a) C/P_K \text{ and } N = (b) C/P_N \quad (4)$$

Substituting the values of K and N in equation (4) into the production function - equation (1):

$$X = A(aC/P_K)^a \cdot (bC/P_N)^b \quad (5)$$

Solving equation (5) for C gives:

$$C = \frac{(P_K)^a (P_N)^b}{Aa^a (b)^b} \cdot X$$

$$\text{Therefore } C/X = (P_K)^a (P_N)^b / Aa^a (b)^b$$

5. See earlier note (note 3) on the constancy of input prices and Appendix A for the assumptions of this study regarding factor shares.
6. Stephen Wheatcroft, The Economics of European Air Transport, Harvard University Press, Cambridge, Massachusetts, 1956, pp. 31-32.
7. Mahlon R. Straszheim, The International Airline Industry, The Brookings Institution, 1969, p. 89.
8. Ibid.
9. Cf. Ibid., p. 93.

10. Ibid., p. 84, and Appendix Tables C-1 and C-2.
11. P. W. Cherington, Airline Price Policy, Harvard University Press, Boston, 1958, pp. 49-62.
12. J. B. Lansing, Transportation and Economic Policy, The Free Press, New York, 1966, p. 317.
13. Over very long stage lengths the longer flying time would become a more important element of crew cost as the earlier discussion suggests.
14. See Alan H. Stratford, Air Transport Economics in the Supersonic Era, St. Martins Press, New York, 1967, pp. 64-75, and Mahlon R. Straszheim, op. cit., pp. 95-104.
15. Even stage lengths as short as 500 miles have permitted substantial operating cost reductions relative to stage lengths of 250 miles. See Ibid., p. 74. North American-Jamaican stage lengths (excepting Miami-Kingston) are far in excess of 500 miles.
16. See for example, Official Airline Guide, R. H. Donnelley Corporation, Oakbrook, Illinois, for equipment used by airlines serving Jamaica.
17. These results represent all aircraft types.
18. International Air Transport Association, Agreeing on Fares and Rates, 1973, p. 91; and The Airlines' Cost/Revenue Struggle in Providing Service to the Public, Tehran Symposium, 26th Annual General Meeting, October 1970, p. 15.
19. See earlier discussion of productivity in the air transport industry.
20. International Civil Aviation Organization, Circular 122-AT/32, op. cit., p. 66.
21. International Civil Aviation Organization, Circular 158-AT/57, op. cit., pp. 63-64.
22. International Air Transport Association (The Airlines' Cost/Revenue Struggle), op. cit., p. 15.
23. Ibid., p. 15.
24. This sequence would affect unit operating cost per tonne-kilometre performed rather than unit operating cost per tonne-kilometre available.

## CHAPTER III

### DEMAND FOR AIR TRANSPORTATION

Since World War II, and especially since the "jet revolution" of the late 1950's, the air transport industry has experienced a rate of growth of demand achieved by few other industries. For the world as a whole, this growth has been approximately 15 percent per year. During the same period, air traffic to Jamaica grew at an annual rate of roughly 12.5 percent.<sup>1</sup> This relatively rapid growth rate of air transport demand has been attributed to a number of factors including increases in real disposable incomes, reduction in real air fares, population growth, reduced fear of flying and changes in tastes and preferences for international travel. A discussion of air transport demand influences will be undertaken later when the demand function is examined in some detail.

#### Background Discussion

As a background to the demand analysis undertaken below, it is appropriate to review briefly some of the conventional theoretical arguments regarding consumer behavior. As a consumer, the individual demands various kinds of goods and services. Presumably, in doing so, he chooses among the alternatives available to him in such a way as to derive the maximum satisfaction from the commodities he consumes. His utility function provides information pertaining to the satisfaction that he derives from various quantities of commodities that he consumes.

Such a utility function can be expressed in familiar form as follows:

$$U = U(X_1, X_2, \dots, X_n).$$

The consumer seeks to maximize  $U$  subject to the budget constraint that:

$$X_1P_1 + X_2P_2 + \dots + X_nP_n = Y$$

where  $P_i$  is the price of the  $i$ th good  $X_i$  and  $Y$  is the consumer's money income. To maximize  $U$  subject to the above constraint, (analytical) use can be made of the following Lagrangian expression:

$$L = U(X_1, X_2, \dots, X_n) - \lambda (X_1 P_1 + X_2 P_2 + \dots + X_n P_n - Y)$$

where  $\lambda$  is a Lagrangian multiplier. Setting the partial derivatives of  $L$  (with respect to  $X_1, X_2, \dots, X_n$  and  $\lambda$ ) equal to zero produces the equations that represent the necessary (first order) conditions<sup>2</sup> for a maximum.

From these conditions it follows that:

$$\frac{\partial U}{\partial X_1} P_1 = \frac{\partial U}{\partial X_2} P_2 = \dots = \frac{\partial U}{\partial X_n} P_n$$

$$X_1 P_1 + X_2 P_2 + \dots + X_n P_n - Y = 0$$

Similarly, for any two commodities  $X_i$  and  $X_j$ ,  $\frac{\partial U / \partial X_i}{\partial U / \partial X_j} = \frac{P_i}{P_j}$ ; that is, the ratio of the marginal utility of these two commodities is equal to the ratio of their prices.

Alternatively, the necessary conditions for a maximum can be written as:

$$P_i = \frac{MU_i}{\lambda} \text{ for every good } i; \text{ that is,}$$

the price of every good that the individual buys represents his evaluation of the utility of the last unit of that good consumed. Therefore the price represents how much the individual is willing to pay for that last unit.<sup>3</sup>

From the necessary conditions for utility maximization indicated above, the optimal levels of  $X_1, X_2, \dots, X_n$  (and  $\lambda$ ) can be derived as functions of all the prices and income. That is, the quantities of  $X_1, X_2, \dots, X_n$  "demanded" by the consumer depend on the shape of the utility function and on  $P_1, P_2, \dots, P_n$  and  $Y$ . The corresponding demand functions are as follows:

$$X_1 = D_1(P_1, P_2, \dots, P_n, Y)$$

$$X_2 = D_2(P_1, P_2, \dots, P_n, Y)$$

⋮

$$X_n = D_n(P_1, P_2, \dots, P_n, Y)$$



Given these demand functions  $D_1, D_2, \dots, D_n$  and the values of  $P_1, P_2, \dots, P_n$  and  $Y$ , it is possible to determine how much of each commodity the consumer will buy.<sup>4</sup>

Turning now to air transportation, it is assumed that the demand for trips depends on the direct utility they yield, and on the contribution they make to a visit to the point of destination.<sup>5</sup> A trip (or trips) can therefore be considered as one of several commodities consumed so as to maximize utility subject to a budget constraint. In terms of the above functional relationships such a trip would constitute one of the commodities included in the utility function, with the corresponding demand for that trip being a function of its own price, the prices of other goods and the consumer's income. This general expression of the demand function does not however fully describe the character of the demand for air transport; thus further elaboration is warranted.

There are several facets of a trip (and the associated visit) that will influence the demand for that trip. These include the transportation services of the airline, transportation services at the point of destination, accommodation and restaurant services, travelling time and time spent at the point of destination. The cost of the trip to the traveler therefore consists of the money and time inputs involved, and these should be important considerations in deciding whether or not to take that trip. Thus the demand for air transport depends not only on the money costs, but rather on the overall opportunity costs involved.<sup>6</sup>

This encompasses the notion of generalized costs, in which context all of the cost items can be reduced to a single monetary measure that combines the important, but different costs which constitute the overall opportunity cost of the trip. With this approach the demand for trips can then be expressed as a function of a single variable, namely, generalized cost.<sup>7</sup> The curious reader however, will no doubt be interested in knowing what comprises this single variable; therefore it is



appropriate to provide an expression of the demand function that "details" the components of generalized costs. This will now be attempted with respect to the demand for air transportation to Jamaica.

Briefly stated, the demand<sup>8</sup> for air transport (number trips) to Jamaica can be expressed as a function of real income and relative prices. Some discussion of these prices is in order. In addition to the real price (air fare) to Jamaica, it is also relevant to consider the ratios of fares to Jamaica and other competing vacation destinations. Consideration must also be given to the relative rates of inflation, that is, the price level in Jamaica compared to that in other competing vacation spots and in the tourists' home country. These rates are particularly relevant with respect to the price of accommodation and other tourist commodities that are complementary to air transport in the "consumption of a vacation."

Also relevant is the price of the Jamaican dollar in terms of the foreigner's unit of money (that is, the exchange rate). It is also appropriate to consider the price of competing modes of transport. In the case of travel to Jamaica, sea transport would be relevant. This however, is not strictly comparable with air travel in that such (sea) transport is typically not priced separately, but is instead tied in with accommodation and other services in a package (cruise) tour. Its relevance becomes more important when one considers the value of time which is another variable that should be included in the demand function.

The list of variables to be included in the demand function could be extended, but those indicated above are considered to be among the most crucial determinants of the demand for air transportation to Jamaica. A demand function incorporating these variables can now be expressed in symbolic form as follows:

$$D_T = f \left( \frac{Y_a}{P_a}, \frac{F_j}{P_a}, \frac{P_j}{P_a}, R_{j,a}, T_v, \frac{F_j}{F_{other}}, \frac{P_j}{P_{other}}, \frac{F_{other}}{P_a}, \frac{P_{other}}{P_a}; \text{Other Influences} \right)$$

- where:
- $D_T$  = number of trips. (Since each trip represents a visit by a tourist, number of trips translates into number of tourist traffic.)
- $\frac{Y_a}{P_a}$  = real per capita income in tourist-generating country a.  
That is,  $Y_a$  and  $P_a$  are money income and price index (CPI) respectively, in country or region a.
- $\frac{F_j}{P_a}$  = real air fare to Jamaica (j) from country a.
- $\frac{P_j}{P_a}$  = an index of prices in Jamaica compared to that in country a, (that is, the relative rates of inflation).
- $R_{j,a}$  = the price of the Jamaican dollar in terms of the unit of money of country a, (that is, the exchange rate).
- $T_v$  = the value of time, (that is, the value of the time inputs involved in the trip—travel time plus length of stay).
- $\frac{F_j}{F_{\text{other}}}$  = the ratio of the fare to Jamaica to fares to other vacation spots.
- $\frac{P_j}{P_{\text{other}}}$  = the ratio of prices in Jamaica to prices in other vacation spots, (that is, the relative rates of inflation).
- $\frac{F_{\text{other}}}{P_a}$  = real air fare to other vacation spots from country a.
- $\frac{P_{\text{other}}}{P_a}$  = an index of prices in other vacation spots compared to that in country a, (that is, the relative rates of inflation).

The derivation of empirical estimates for the demand function stated above would require further refinement of definitions, assumptions and measurement techniques regarding the variables listed above. Furthermore, the data needs and the associated task of assembling such data are of such magnitude as to warrant separate study. The most severe problem however, is that of data availability. Much effort was made in this study to assemble data on many of the variables

indicated above, but such effort was frustrated by the encounter of incomplete, poor quality, or non-existent data.

This is not a peculiar nor unusual problem. Empirical investigations are typically confronted with data inadequacies which might dictate the exclusion of some important variables; the result being that the analytical model applied is of necessity often under-specified. This is true of the demand function ultimately estimated below. It should be noted however that such justification for the omission of variables does not free the analysis of the charge that it suffers from some limitations.

Recognizing such limitations, this study and several others (see Table III-4) focus on the income and price determinants in analyzing the demand for air transportation. With income relating to the spending ability of the relevant market, and price (fare) to the cost of using the airline service, these are no doubt two of the most important demand factors. The use of per capita income data allows for the effects of a growing population on demand.<sup>9</sup> Further discussion of these variables is undertaken below. It should be noted that the limited form of the demand function estimated below is based on the simplifying ceteris paribus assumption (that is, all other variables in the expanded demand function indicated above are held constant in the analysis).

### The Framework

The basic demand analysis that follows involves the use of the ordinary least squares regression technique with time series data to estimate a simple demand function. Over the past several years, there have been important changes in such determinants of air transport demand as air fares and consumers' incomes, and therefore these changes permit the use of time series data to estimate demand elasticity. The demand function estimated below is of the double-logarithmic form:

$$\log T = \log E_0 + E_y \log Y + E_p \log P + u \quad (\text{III-1})$$

where  $T$  = yearly traffic measured by the number of passengers (see details below).

$Y$  = real disposable income per capita in constant dollars.

$P$  = price (air fare) in constant dollars.

$E_y$  = income elasticity.

$E_p$  = price elasticity.

It should be noted that this simple form of the demand function is assumed to yield constant estimated elasticities. That is, the elasticity coefficients of the independent variables do not vary along this demand curve. Note also that the estimated effect of these variables on the dependent variable assumes the ceteris paribus condition with respect to other demand-determining variables.

#### The Variables

For purposes of this study, the series for the variables specified above were derived as follows. The traffic series consists of the annual number of passengers between North America (United States and Canada) and Jamaica, since Jamaica receives nearly all<sup>10</sup> of its tourist visitors from these two countries. Much thought and effort were given to analyzing the United States and Canadian air passenger demand separately, as opposed to the combined North American demand. In doing so, several variants of the demand function stated above were fitted separately to several variants of the basic data relating to air traffic between the United States and Jamaica, and between Canada and Jamaica. In no case were the results for both countries completely satisfactory in terms of standard statistical criteria. Among the unsatisfactory results were elasticity coefficients that were not statistically significant, and some that had perverse signs. Several attempts<sup>11</sup> to improve on these results were only "marginally" rewarding in terms of the criteria indicated above.

Analysis of the combined North American market produced results that are superior to those obtained from the separate United States and Canadian markets.<sup>12</sup> One important result is that both the income and price elasticity estimates obtained for the North American market make sense as structural estimates. These are given below.

Although much effort was made in this study to derive good estimates for the United States and the Canadian air transport demand separately, there is no strong a priori reason to suspect that the basic character of those estimates is different for these two countries. If anything one should expect parallel behavior of these two countries' traffic and therefore closely similar demand estimates. This is so because of several relevant similarities between the United States and Canada. Gray<sup>13</sup> has pointed out some analytical resemblances in the demand for foreign travel services (chief of which is air transport) by the residents of these two countries. Given these similarities, there is no reason to be concerned that any serious violence has been done by combining the United States and Canadian traffic data, especially when this procedure improves the quality of the analytical results.

For the price variable, the economy class return air fare between New York City and Kingston, Jamaica was used. Given the primary areas of origin of North American traffic to Jamaica (see footnote 10) this study considers New York to be a sufficiently "central" (pivotal) city for this purpose. The "current" dollar amounts of fare were obtained from the Official Airline Guides (OAG-North American Edition), then these values were deflated by the consumer price index. This same deflator was applied to the income variable which is expressed in terms of the real disposable income per capita for North America, and is a weighted average of the United States and Canadian per capita incomes. For values of the dependent and independent variables see Table III-1.

The annual percentage changes in these variables are shown in Table III-2 and Figure III-1. Note that excepting for two early years in the study when air fare

behaved erratically, real disposable income and real air fare have been relatively stable compared to air traffic. The relatively small changes in real disposable income and real air fare compared to traffic have implications for the sensitivity of the dependent variable to the independent variables and hence the elasticity of demand. Note also that while the relationship is not always consistent nor pronounced, for the most part the year-to-year correspondence between fare and traffic has been inverse, and that between income and traffic direct. It will also be observed that the trend in fare has been reversed in the most recent years of the study, and that for most of those years the increases in traffic were either relatively small or negative. The inverse and direct relationships indicated above are verified by the regression results given below.

#### Results of the Analysis

The data provided in Table III-1 were used to fit the demand equation shown below:

$$\log T = 0.9354 + 2.2266 \log Y - 1.4723 \log P \quad (\text{III-2})$$

$$(SE = 0.2438) \quad (SE = 0.2589)$$

$$\begin{array}{ll} R^2 & = 0.8902 \\ SER & = 0.0872 \end{array} \quad \begin{array}{ll} \bar{R}^2 & = 0.8786 \\ DW & = 1.6267 \end{array}$$

As the above relationships show, the coefficients in the demand equation have the theoretically correct signs, and the test results indicate that they are significant at the 5 percent level (Table III-3). The coefficient of determination ( $R^2$ ) is high and significant, and therefore indicates that real disposable income and real air fare are proper explanatory variables of the demand for air transportation to Jamaica. In addition there is no evidence of any significant degree of serial correlation as the Durbin-Watson statistic indicates.<sup>14</sup>

Further analysis of the regression results involved additional testing of hypotheses with respect to the estimated elasticity coefficients (Table III-3). Rejec-



TABLE III-1

AIR TOURIST TRAFFIC FROM NORTH AMERICA TO JAMAICA,  
AND EXPLANATORY VARIABLES, 1960-1981.

| Year | Air Tourist<br>Traffic<br>(Number) | North American<br>Real Disposable<br>Income per capita<br>(1972 Dollars) | Real<br>Air Fare <sup>a</sup><br>(1972 Dollars) |
|------|------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------|
| 1960 | 80,036                             | 2614                                                                     | 285.35                                          |
| 1961 | 73,402                             | 2637                                                                     | 296.35                                          |
| 1962 | 74,241                             | 2708                                                                     | 305.71                                          |
| 1963 | 78,797                             | 2764                                                                     | 436.74                                          |
| 1964 | 94,100                             | 2916                                                                     | 297.23                                          |
| 1965 | 141,257                            | 3112                                                                     | 291.83                                          |
| 1966 | 180,469                            | 3236                                                                     | 283.73                                          |
| 1967 | 189,964                            | 3326                                                                     | 276.75                                          |
| 1968 | 227,145                            | 3421                                                                     | 265.96                                          |
| 1969 | 241,241                            | 3482                                                                     | 254.23                                          |
| 1970 | 267,850                            | 3577                                                                     | 250.81                                          |
| 1971 | 320,625                            | 3675                                                                     | 246.38                                          |
| 1972 | 344,522                            | 3809                                                                     | 250.00                                          |
| 1973 | 362,182                            | 4036                                                                     | 243.60                                          |
| 1974 | 377,139                            | 3965                                                                     | 226.69                                          |
| 1975 | 344,095                            | 4016                                                                     | 224.68                                          |
| 1976 | 277,854                            | 4129                                                                     | 230.28                                          |
| 1977 | 253,539                            | 4270                                                                     | 234.43                                          |
| 1978 | 289,335                            | 4430                                                                     | 239.35                                          |
| 1979 | 307,749                            | 4473                                                                     | 243.90                                          |
| 1980 | 310,340                            | 4454                                                                     | 251.41                                          |
| 1981 | 315,864                            | 4518                                                                     | 257.93                                          |

Sources: Column 2, Jamaica Tourist Board, Travel Statistics (Various Issues), and National Planning Agency of Jamaica, Economic and Social Survey of Jamaica (Various Issues); Column 3, Survey of Current Business (Various Issues) and United Nations, Statistical Yearbook, United Nations, New York, (Various Issues); Column 4, Official Airline Guides, North American Edition (Various Issues).

<sup>a</sup> Airfare is the New York-Jamaica return economy fare. (see footnote 10 and assumption in text).

TABLE III-2

ANNUAL PERCENTAGE CHANGES IN TRAFFIC, REAL  
DISPOSABLE INCOME PER CAPITA AND REAL AIR  
FARE, NORTH AMERICA-JAMAICA AIR TOURIST  
TRAFFIC, 1960-1981.

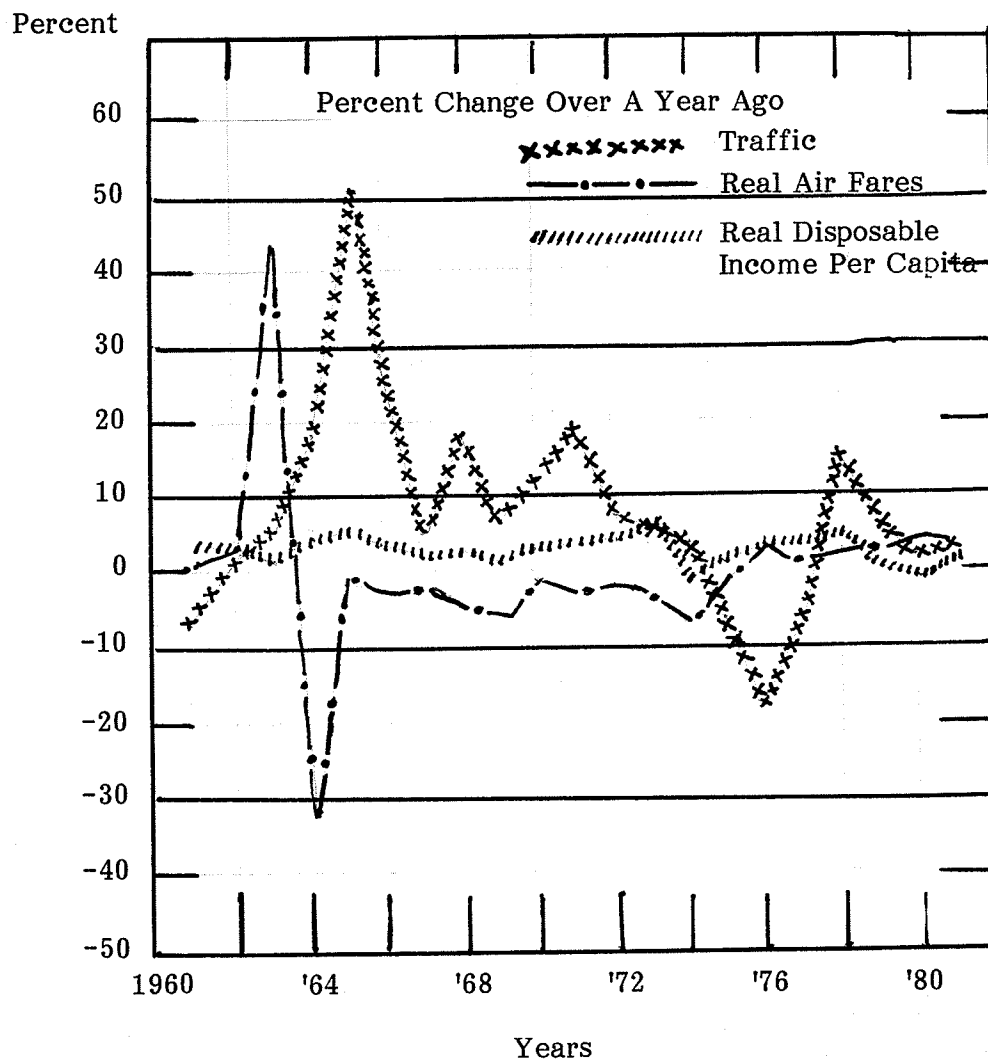
| Year | Air Tourist<br>Traffic<br>(Percent Change from Previous Year) | Real Disposable<br>Income Per Capita | Real<br>Air Fare |
|------|---------------------------------------------------------------|--------------------------------------|------------------|
| 1960 | -                                                             | -                                    | -                |
| 1961 | -8.29                                                         | 0.88                                 | 3.83             |
| 1962 | 1.14                                                          | 2.69                                 | 3.18             |
| 1963 | 6.14                                                          | 2.07                                 | 42.86            |
| 1964 | 19.42                                                         | 5.50                                 | -31.94           |
| 1965 | 50.11                                                         | 6.72                                 | - 1.82           |
| 1966 | 27.76                                                         | 3.98                                 | - 2.78           |
| 1967 | 5.26                                                          | 2.78                                 | - 2.46           |
| 1968 | 19.57                                                         | 2.86                                 | - 4.00           |
| 1969 | 6.21                                                          | 1.78                                 | - 4.40           |
| 1970 | 11.03                                                         | 2.73                                 | - 1.34           |
| 1971 | 19.70                                                         | 2.74                                 | - 1.77           |
| 1972 | 7.45                                                          | 3.65                                 | 1.47             |
| 1973 | 5.12                                                          | 5.96                                 | - 2.56           |
| 1974 | 4.13                                                          | -1.76                                | - 6.94           |
| 1975 | -8.76                                                         | 1.29                                 | - 0.89           |
| 1976 | -19.25                                                        | 2.81                                 | 2.49             |
| 1977 | -8.75                                                         | 3.41                                 | 1.80             |
| 1978 | 14.12                                                         | 3.75                                 | 2.10             |
| 1979 | 6.36                                                          | 0.97                                 | 1.90             |
| 1980 | 0.84                                                          | -0.42                                | 3.08             |
| 1981 | 1.78                                                          | 1.44                                 | 2.59             |

Source: Computed from Table III-1.



FIGURE III-1

ANNUAL PERCENTAGE CHANGES IN TRAFFIC COMPARED  
TO REAL DISPOSABLE INCOME PER CAPITA AND REAL  
AIR FARE, NORTH AMERICA-JAMAICA AIR TOURIST  
TRAFFIC, 1960 - 1981.



Source: Table III-2.

TABLE III-3

HYPOTHESIS TESTING FOR PRICE AND INCOME ELASTICITY OF DEMAND FOR AIR  
TRANSPORT - NORTH AMERICAN AIR TRAFFIC TO JAMAICA, WEST INDIES

| Hypothesized Elasticity Coefficient |                        | Estimated Elasticity Coefficient <sup>a</sup><br>(Absolute Values) | Standard Error | t-Statistic         | Degrees of Freedom | Action On Hypothesis            |
|-------------------------------------|------------------------|--------------------------------------------------------------------|----------------|---------------------|--------------------|---------------------------------|
| Null Hypothesis                     | Alternative Hypothesis |                                                                    |                |                     |                    |                                 |
| $E_H = 0$                           | $E_A \neq 0$           | 2.226 (Income)                                                     | 0.2438         | 9.1325 <sup>b</sup> | 19                 | Reject Null; Accept Alternative |
| $E_H = 0$                           | $E_A \neq 0$           | 1.472 (Price)                                                      | 0.2589         | 5.6867 <sup>b</sup> | 19                 | Reject Null; Accept Alternative |
| $E_H \leq 1$                        | $E_A > 1$              | 2.226 (Income)                                                     | 0.2438         | 5.0311 <sup>b</sup> | 19                 | Reject Null; Accept Alternative |
| $E_H \leq 1$                        | $E_A > 1$              | 1.472 (Price)                                                      | 0.2589         | 1.8242 <sup>b</sup> | 19                 | Reject Null; Accept Alternative |

Source: Calculations made by writer.

<sup>a</sup>Obtained from regression results; see text.

<sup>b</sup>Significant at the 5 percent level.

tion of the null hypothesis that these coefficients are no greater than unity ( $E \leq 1$ ) supports the evidence that the demand by tourists for air transportation to Jamaica is both income and price elastic. As these coefficients indicate, a rise in real disposable income of one percent would cause air traffic from North America to Jamaica to increase by about 2.23 percent, while a cut in air fare by one percent would cause such traffic to increase by about 1.47 percent.

#### Other Demand Estimates

The results of this study regarding the elasticity of demand for air transportation are supported by evidence from several other studies.<sup>15</sup> A brief discussion of some of these studies is in order. In general, they were all conducted within the same analytical framework; that is, the demand for air transportation was formulated as a linear function of income and price. These studies tend to suffer from a common problem.

This basic problem is that as time series models they use historical data which incorporate the cumulative effects of many variables, and so the variables that are of interest tend to experience little independent variation over time. Hence a true assessment of their individual influences is difficult. That is, the parameter estimates of the demand equation tend to reflect the joint effect of many variables.<sup>16</sup> Price (air fare) changes for example have been accompanied by numerous other changes such as changes in real disposable incomes, more comfortable jet aircraft, reduction in the fear of flying and so forth. These many influences compound the effect of the individual variable such that its parameter estimate is not likely to be an exact measure of its individual effect on traffic. This point is made here to suggest that the income and price elasticity coefficients so derived should not be interpreted as definitive measures, but rather as representative of the character of the demand for air transportation.

It should be noted however that these studies (see Table III-4 and footnote 15) consistently arrived at the same conclusion regarding the elasticity of demand for air transportation. Furthermore, they covered different though sometimes overlapping time periods and different traffic markets. A brief description of these studies follows.

In Study I (see Table III-4) the dependent variable was traffic measured in terms of passenger-kilometres. The independent variables were disposable income per capita and average revenue per passenger-kilometre. The study was concerned with estimating the income and price elasticities of demand for European air travel and then forecasting that demand for the period 1968-1980. However similar elasticity results were obtained when the model was tested in two other markets (the United States domestic and the international air travel markets) for the period 1962 to 1968 (see reference in Table III-4).

Study II used air passenger-miles per capita per year as the dependent variable with the explanatory variables being disposable personal income per capita, average fare per mile, and time. Unlike the other studies discussed here, that study (Study II) related the relative change in traffic to the relative change in income and in fare from year to year, instead of relating total traffic to the levels of income and fare in each year. The significance of this modification of the basic model is that the constant term in the demand function represents a time influence on traffic that is not so provided for by the other studies. In this specification of the model, the sum of the constant term and the parameter value for the variable time indicates the annual percentage change in traffic that would have occurred if income and fares were constant in money terms. The results of the study which covered the United States domestic market for the period 1946-1966 showed that the time variable had a negative coefficient which indicates that the rate of "automatic" growth of traffic tends to decrease with time (see reference in Table III-4).

For Study III, the dependent variable expressed as the number of passengers travelling between two countries was made a function of gross national product per capita of these two countries, and a typical air fare for travel between the two countries. Focus of the study was on the elasticity of demand for air travel between pairs of countries in Europe, and forecasting such travel for the period 1968-1980 (see reference in Table III-4). The results of these studies are summarized in tabular form below.

None of the studies reported in the table involved a predominantly tourist market such as the Caribbean. One would expect that in a tourist-oriented market (pleasure travel) these elasticity coefficients would be higher than say in the intra-European or United States domestic markets which consist of a mixture of business and pleasure air travelers. On the other hand, shorter trips within Europe and within the United States (compared to say a United States-Jamaica trip), and the availability of good substitute surface transportation such as the automobile in these two travel markets would tend to make the price elasticity of demand for air travel in these markets relatively high compared to the United States-Jamaica market where fewer such substitutes are available. These possible offsetting circumstances help to explain why the elasticity coefficients derived by this study for the North American-Jamaica market are roughly of the same magnitude as those presented in Table III-4.

#### Implications for Traffic

Turning now to the relevance of income and price elasticities for the observed growth of air traffic to Jamaica, it should be noted that for most of the period under study (up to 1974), tourist air traffic to Jamaica grew at an annual rate of approximately 12.5 percent (Chapter VI). During the same period real disposable incomes in North America rose at an annual rate of 2.8 percent while air

TABLE III-4

ESTIMATES OF INCOME AND PRICE ELASTICITIES OF  
DEMAND FOR AIR TRANSPORTATION DERIVED BY  
OTHER STUDIES.

| Study* | Income Elasticity | Variable Used                     | Price Elasticity | Variable Used                      |
|--------|-------------------|-----------------------------------|------------------|------------------------------------|
| I      | 1.6               | Disposable Income Per Capita      | -1.5             | Average Fare per Mile or Kilometre |
| II     | 1.1               | Disposable Income Per Capita      | -1.3             | Average Fare per Mile or Kilometre |
| III    | 1.6               | Gross National Product Per Capita | -1.6             | Average Fare                       |

Source: International Civil Aviation Organization Manual on Air Traffic Forecasting, DOC. 8991-AT/722, 1972, p. 32; for Study I see B. Bjorkman, Forecast of Intra-European Scheduled Air Passenger Travel 1968-1980, European Civil Aviation Conference (ECAC) Doc. No. 3, 1970; for Study II see Samuel L. Brown and Wayne S. Watkins, "The Demand for Air Travel: A Regression Study of Time Series and Cross-Sectional Data in the U. S. Domestic Market," National Research Council, Passenger Transportation-Highway Research Record No. 213; for Study III see European Civil Aviation Conference, Forecast of Intra-European Scheduled Air Passenger Travel 1968-1980, ECAC Doc. 3, 1970.

\*Note that these studies used variables similar to those used in this study.



fares (in real terms) between North America and Jamaica fell at an annual rate of about 1.5 percent (Table III-1).

Given the earlier evidence with respect to the income and price elasticity of demand for tourist air travel, the rise in real disposable income and the fall in real air fares have important implications for this growth of traffic. That is, other things being equal, a given percentage increase in real disposable, and a given percentage decrease in air fares will each cause traffic to grow at a rate faster than the change in income and fares. The observed growth rate of traffic can therefore be attributed to the observed changes in these demand factors.<sup>17</sup>

The evidence is consistent with the theoretical stipulation concerning demand elasticity. With respect to price elasticity, theory suggests that tourists (i.e. pleasure travelers as opposed to business travelers) will be quite sensitive to fare changes and hence have a relatively high price elasticity of demand. That is, unlike the business traveler, the potential tourist will be more easily lured by a fare decrease or repelled by a fare increase, since pleasure travel tends to be more optional in nature, and is likely to involve less of a time and place constraint than business travel. For instance, the potential tourist may face a wide range of alternative vacation spots including those accessible by car and other modes of surface transportation, so that the availability of those substitutes would make the demand for air transport more price-elastic.

It should be noted that substitute vacation destinations should in this case be viewed within the context of climatic attraction. Jamaica's reputation as a tourist mecca has been built largely on her salubrious climate (particularly her winter weather) which permits the enjoyment of such complementary tourist attractions as her beaches. Thus travel to Europe for instance, is not directly competitive with travel to Jamaica by those tourists who are "sun-seekers."

Therefore given the predominantly eastern origin of the North American traffic to Jamaica (see footnote 10) and the travel distances involved, relevant

substitutes would be other Caribbean islands (such as Puerto Rico and the Virgin Islands) to which the cost of air travel approximates that to Jamaica, or places like Florida and Mexico which can be visited by means of road travel. It is these alternative vacation destinations which permit the use of relatively cheap surface transportation that are of particular importance concerning the price-elastic nature of North American tourist demand for air transportation to Jamaica.

Further, air fare is likely to constitute a large part of a foreign vacation budget, and this will tend to make the demand for air transportation elastic. For instance, the cost of air transportation (air fare) may constitute roughly 40 percent of the total cost of a 10-day Jamaican vacation to an American tourist who originates within the vicinity of New York City if he spends about \$60<sup>18</sup> per day in Jamaica on accommodation, food, recreation, local transportation, and so forth. For the American or Canadian tourist who hails from a further distance away from the Caribbean, his fare would be an even higher percentage of a similar Jamaican vacation cost. Such an air fare may not only account for a large portion of the vacation budget, but may also constitute a good portion of the total budget of the "average tourist" (consumer), so that he would be quite responsive to fare changes.

With respect to income elasticity, the magnitude of the coefficient derived ( $E > 1$ ) is also consistent with expectations. That is, one would expect to find "high" income elasticities associated with "growth" industries such as air transportation (see earlier evidence). In such industries<sup>19</sup> product demand grows more rapidly than does total consumer income<sup>20</sup> with obvious implications for elasticity. The converse is also true, and suggests that these industries are among those that are most vulnerable to fluctuations in the level of aggregate economic activity.

Another inference that can be drawn from the income elasticity result obtained in this study is the class of goods and services to which air travel to Jamaica belongs. As any basic text in microeconomic theory will show, it has become



standard procedure for economists to use income elasticity to classify products into necessities, luxuries and inferior goods. According to this criterion, goods whose income elasticity of demand is greater than unity are luxuries. Therefore, tourist air travel to Jamaica would fall into this category. The reader should however be reminded that this classification of goods as used by economists is based on analytical definitions and therefore bypasses value judgements of what products are luxuries, necessities or inferior goods. From the standpoint of consumers, it is conceivable that what is luxury to some may be inferior to others.<sup>21</sup>

This is so because the income elasticity of demand for a product may exhibit considerable variation depending on consumers' incomes.<sup>22</sup> The coefficient of income elasticity may be "high in some ranges of incomes and "low" in others. The percentage of income spent on the product, is a major determinant of how high or low is the income elasticity of demand for that product. In general, this coefficient tends to be larger for those products which take a sizable part of the buyer's income than for those which are relatively inexpensive.

Given these observations, the income elasticity coefficient derived earlier in this study suggests that air travel to Jamaica by North American tourists constitutes a major expenditure relative to their incomes. One implication of this is that these tourists are likely to be bargain-seekers with respect to the prices they have to pay in the host country (Jamaica) for goods and services that are complementary to air travel in terms of the total vacation package. That is, they may seek for instance to help balance the cost of air transportation with relatively inexpensive hotel accomodation. This is a matter for "tourist firms" and the host country's government to consider in the planning and provision of tourist facilities.

The above discussion on elasticity of demand suggests that a fall in real disposable income and a rise in air fare will cause a proportionately larger decline in air traffic volume to Jamaica. The evidence cited earlier indicates that while

the disposable income of the relevant population has continued to increase, the earlier downward trend in air fares has been reversed during the most recent years included in this study. The overall trends of these independent variables and their implication for the future growth of traffic to Jamaica will be investigated in Chapter V.

## CHAPTER III

## NOTES

1. International Civil Aviation Organization, A Review of the Economic Situation of Air Transport, Circular 105-AT/26, 1971, pp. 2-6; Circular 122-AT/32, 1974, pp. 1-2; Circular 133-AT/40, 1977, pp. 1-2; Circular 158-AT/57, 1980, pp. 1-2; Mahlon R. Straszheim, op. cit., p. 108; Jamaica Tourist Board, Travel Statistics-Jamaica, Kingston, Jamaica 1971, and National Planning Agency, Economic and Social Survey of Jamaica, Kingston, Jamaica, (Various Annual Issues). The Jamaican growth rate has fallen since 1974 to make the average less than 12.5 percent per year. See Chapter V also.

2. These conditions are:

$$\frac{\partial L}{\partial X_1} = \frac{\partial U}{\partial X_1} - \lambda P_1 = 0$$

$$\frac{\partial L}{\partial X_2} = \frac{\partial U}{\partial X_2} - \lambda P_2 = 0$$

⋮

$$\frac{\partial L}{\partial X_n} = \frac{\partial U}{\partial X_n} - \lambda P_n = 0$$

$$\frac{\partial L}{\partial \lambda} = X_1 P_1 + X_2 P_2 + \dots + X_n P_n - Y = 0$$

The second-order (sufficient conditions for a maximum will not be presented here; but it should be noted that the assumption of diminishing marginal rate of substitution between any of the two commodities in the utility function is sufficient to ensure that any point obeying the above first order conditions is in fact a true maximum. Cf. Walter Nicholson, Microeconomic Theory, The Dryden Press, Hindsdale, Illinois, 1977, pp. 74-76, or any other basic text on microeconomic theory.

3. Ibid.
4. Ibid.
5. Cf. Reuben Gronau, The Value of Time in Passenger Transportation: The Demand for Air Travel, National Bureau of Economic Research, Occasional Paper 109, 1970, p. 12.
6. This is not a peculiarity of air transport demand, but it is appropriate to note, in that the money cost of the trip may constitute only a relatively small portion of the overall costs involved in the visit. Cf. K. J. Button, Transport Economics, Heinemann Educational Books Ltd., London, 1982, pp. 97-99. Later in this chapter air transport cost (air fare) is compared with total vacation cost for a hypothetical case. It should be noted however, that that comparison involves only money costs and not overall opportunity costs; hence that result is not necessarily inconsistent with the above statement attributed to K. J. Button.

7. Generalized costs can be defined as:  $G = g(C_1, C_2, C_3, \dots, C_n)$ , where  $G$  = generalized cost, and  $(C_1, C_2, C_3, \dots, C_n)$  are the different money, time and other costs of travel. Thus the demand for trips can be expressed as  $D_T = f(G)$ . For the ideas presented here, and a fuller discussion of the notion and computation of generalized costs, see Ibid. pp. 98-99.
8. This is total or market demand which is the summation of individuals' demand. Thus it is based on the same theoretical arguments presented earlier with respect to the individual consumer (traveler).
9. Cf. Samuel L. Brown and Wayne S. Watkins, "The Demand for Air Travel: A Regression Study of Time-Series and Cross-Sectional Data in the U. S. Domestic Market," National Research Council, Passenger Transportation-Highway Research Record No. 213, p. 25.
10. Over 90 percent of the tourist traffic received in Jamaica originate in the United States and Canada. Further, this traffic is mainly from the eastern parts of these countries, with about 75 percent of the annual tourist traffic from the United States to Jamaica coming from the eastern states, and about 88 percent of the Canadian traffic to Jamaica originating in the eastern provinces. See Jamaica Tourist Board, Travel Statistics (Various Annual Issues).
11. These attempts included the transformation of variables (first differencing), the elimination of variables (one at a time) and the use of a shift (dummy) variable to deal with what appears to be some structural changes in the data,
12. A possible explanation for the superior results is that bumps (structural changes) in the data are ironed out in the "aggregation" process. As footnote 11 above indicates, some attempt was made to deal with such structural changes.
13. Gray observed that (1) there is extensive travel between the United States and Canada by the residents of both countries (2) the residents of both countries are faced with high transportation cost if travel to any other country is to be undertaken (3) both nations are very affluent and (4) both nations are large. He also noted that the cultural and geographic similarities between these two countries are such that "travel in the neighboring country can be a close substitute for domestic travel and travel to the neighboring country can, for this reason, be estimated separately from and considered independent of travel to other nations." See H. Peter Gray, International Travel-International Trade, D. C. Heath and Company, Lexington, Massachusetts, 1970, p. 54. In addition another similarity between the United States and Canadian travel pattern and traffic data was identified by this study. With the help of data presented later in this chapter, it was determined that the rate of United States air travel to Jamaica, and the rate of Canadian air travel to Jamaica are quite similar. That is, for 15 of the 22 years (1960-1981) examined in this study there was approximately one "air tourist" going to Jamaica per 1000 population for both the United States and Canada.
14. The null hypothesis that no positive serial correlation is present was tested at the 0.05 level of significance, and was accepted—that is,  $d_u < DW < 2$ .

15. See for example Bo Bjorkman "Methods of Research Into the Elasticity of Demand for Air Transport," ITA Studies (Paris: Institut du Transport Arien, November 1964)), p. 10; Harold W. Guthrie, "Demand for Tourists' Goods and Services in a World Market." Cowles Foundation Paper, No. 201; International Union of Official Tourist Organizations, Study on the Economic Impact of Tourist on National Economies and International Trade, (Geneva, 1966), p. 15; Mahlon R. Straszheim, op. cit., p. 129; and Samuel L. Brown and Wayne S. Watkins, op. cit., p. 26. See also Table III-4.
16. Cf. Mahlon R. Straszheim, op. cit., pp. 123-125.
17. As indicated earlier, there are other demand influences that contribute to the growth of air traffic.
18. Obviously this figure will vary depending on the visitor's choice of accomodation, food and so forth. The estimates made here are based on 1982 rates.
19. Some question may arise as to how one defines a growth industry, and within what range of growth rates does an industry qualify. However, since the earlier evidence indicates that air transportation has been one of the fastest growing industries in recent decades, and since there has been no known dispute over that claim, the categorization of air transportation as a growth industry does not seem to warrant a debate in the current context.
20. This study uses per capita instead of aggregate consumer income as an independent variable. However, the evidence indicates that both categories of income have been increasing over time. See for example, The United Nations, Statistical Yearbook (Various Annual Issues).
21. Professor P. S. Dhruvarajan has suggested that air travel to Jamaica could be a luxury good for those who do not travel, but a Giffen good for those who do travel. Since the price of a trip is "high" and the trip is not divisible, then most individuals may be left with the choice of either one trip or none in one year. If for instance air fare rises, then presumably those to whom air travel is a Giffen good would take the trip, but those to whom it is a luxury may not. Those who do travel may find that even with higher fares, the cost of a trip to Jamaica is still a good bargain relative to the cost of travel to some more distant places like Hawaii.
22. Cf. Edwin Mansfield, Microeconomics, W. W. Norton and Company, New York, pp. 90-92, and Donald Watson and Mary Holman, Price Theory and Its Uses, Houghton Mifflin Company, Boston, 1977, pp. 52-54.



## CHAPTER IV

### THE NATURE OF COMPETITION AND PRICING

This chapter will investigate some other market structure characteristics of the air transport industry, as they affect the growth of air traffic and hence tourism. The discussion will focus on the number of firms (airlines) in the relevant market, airline pricing including the functioning of the IATA rate machinery, and the role of air charter service vis a vis scheduled service. These will be examined in turn.

#### Number of Firms and Conditions of Entry

The number and size distribution of firms in a market can be expected to influence the behavior of those firms, and consequently the economic performance of the industry. The conditions of entry constitute an important dimension of market structure and are often determined by such factors as the absolute cost requirements, the scale of operations, and the degree of product differentiation characteristic of the market. In the case of international air transport, another condition of entry must be added. This is the bilateral process which governs the entry of airlines into the relevant market.

The economic barriers to entry into the airline industry can be surmounted with relative ease. For instance, the relatively large capital requirements<sup>1</sup> for jet technology might be expected to forestall airlines' entry into jet operation. However, the political and competitive motivation of some airlines, and the existence of favorable capital markets have been important contributors to a lowering of the absolute cost barrier to entry. In many countries low cost capital is made available to airlines through government subsidy. Pooling arrangements and

financing arrangements such as those between Air Jamaica<sup>2</sup> and Air Canada have also helped greatly in mitigating the capital problem of the airlines of less developed countries.

In the United States, a favorable capital market exists for jet financing, and this market is not confined to airlines of American nationality, but is open also to the airlines of some of the less developed countries. Private capital for jet financing is available at competitive long-term rates from such sources as banks and insurance companies. These sources have apparently been convinced of the soundness of such capital investment because of the profit potential of jet operation and the relative ease in reselling jet aircraft.<sup>3</sup>

Thus the large capital requirements of jet technology have been no serious deterrent to its adoption by the airline industry. Instead, the response of capital sources to the capital needs of the jet era has accelerated the trend toward greater use of jet equipment. The "product" differentiation barrier to entry is also low because of the relative ease with which an airline can adopt from its competitors those features of equipment and service which influence consumers' choice.

The noneconomic barrier imposed by bilateral agreements appear somewhat more difficult to overcome since potential entrants (and established firms) have virtually no control over the conditions of the agreement under which they must operate. However, these entry conditions of bilateral agreements have important economic implications. Because entry is controlled by the nations involved in a bilateral agreement, airlines more efficient than those of the contracting nations may be excluded<sup>4</sup> from a market. Also, the right of the contracting nations to participate in the relevant market may result in economically unwarranted entry of the two nations' carriers in a market that could be more efficiently served by one carrier. This is particularly likely in the case of flag carriers supported by government subsidy. There are also certain provisions of bilateral agreements

involving schedules and intermediate (fifth freedom)<sup>5</sup> traffic, and these could be so restrictive as to make it uneconomical for some airlines to operate especially on routes of low density.<sup>6</sup>

In most air markets, the number of firms constitutes an oligopoly. This is certainly true of North American-Jamaican operation. For instance, in the winter of 1981, six airlines provided regularly scheduled service between major population centers of the North American continent and Jamaica. Such service is characterized by a high degree of seller concentration as can be expected from a market comprised of only six firms.

The limitations of various measures of concentration are discussed in the relevant literature, and it is neither appropriate nor convenient to review them here. In the case of the airline industry such measures as the percent of total traffic, or the percent of revenue tonne-kilometres performed by a given number of airlines are suggested by the data reported by the International Air Transport Association (I.A.T.A.) for international airlines, and by the Civil Aeronautics Board (C.A.B.) for United States domestic airlines.

Using the available data, this study improvises a measure of concentration based on the frequency of flights<sup>7</sup> by different airlines between North America and Jamaica. It is recognized that such frequencies reflect agreements between the countries involved rather than competition among the airlines, but they do give some indication of the market shares of these airlines. Further, it is reasonable to infer traffic or revenue shares from frequencies if it is assumed that the higher frequency of some airlines is not at the expense of relatively high load factors.

Of a total of 180 scheduled flights per week between North America and Jamaica during the winter of 1981, three of the six airlines accounted for 153 or 85 percent of those flights (Table IV-1). It is easy to see that these "pseudo-concentration" ratios would be even higher for city-pair markets in which fewer airlines operate. For instance, between New York City and Kingston, Jamaica, Air



TABLE IV-1

SHARE OF WEEKLY NORTH AMERICAN-JAMAICAN FLIGHTS  
ACCOUNTED FOR BY DIFFERENT AIRLINES, WINTER 1981.

| Airline                     | <u>Weekly North American-Jamaican Flights</u> |         |
|-----------------------------|-----------------------------------------------|---------|
|                             | Number                                        | Percent |
| Air Jamaica                 | 105                                           | 58.3    |
| Air Florida                 | 28                                            | 15.6    |
| American Airlines           | 20                                            | 11.1    |
| Air Canada                  | 14                                            | 7.8     |
| Eastern Airlines            | 7                                             | 3.9     |
| British West Indian Airways | 6                                             | 3.3     |

Source: R. H. Donnelly Corporation, Official Airline Guide, (North American Edition), Oak Brook, Illinois, December 1981.

Jamaica and American Airlines accounted for 100 percent of those flights. Similarly Air Canada and Air Jamaica accounted for all of the flights between Toronto and Kingston during the same period.<sup>8</sup>

On a route served by only two airlines, it is possible that a large airline like Air Canada could, in the absence of regulation price a relatively small airline like Air Jamaica out of the market unless the latter is maintained through subsidy. If this should happen, the impact on traffic growth could be restrictive as the large airline could raise<sup>9</sup> its fares after it has successfully imposed a cost-price squeeze on its smaller rivals. However, any such increase in fares would be temporary or of limited magnitude; for if the fare level is elevated above costs such that the level of profits invites the entry<sup>10</sup> of new airlines, the competition for market shares that results would start the fare level moving downwards and traffic volume upwards.

Given the regulatory environment in which airlines operate, the number of firms has more important implications for operating efficiently than for pricing. Thus with fewer firms and the possibility of larger market shares, these firms can achieve a higher load factor and utilization rate of equipment which contribute to cost reduction. If lower costs motivate airlines to seek lower fares through the I.A.T.A. machinery, this would help to generate traffic and further enhance the airlines' economic position, as their total revenue would also increase in accordance with the elastic demand for their service.

### Airline Pricing

The price system does not operate freely in the airline industry. The market mechanism is distorted by price regulation such that prices (fares) bear no necessary relationship to the equilibrium between the demand for, and the supply of air transport services. The rate-making process is explained briefly below. Charter

service which is granted relief from the regulatory pricing machinery also has implications for pricing and traffic growth in the industry as a whole, and will be discussed below.

### The Functioning of the I.A.T.A. Rate-Fixing Machinery

The international control of airline prices (fares and rates) has been the responsibility of the International Air Transport Association (IATA) since World War II. Each year the Association's Traffic Conferences meet to decide on fares and rates. The implementation of these conference decisions is contingent upon their approval by the governments involved. However, experience over the past two decades suggests an harmonious blend of I.A.T.A. and governmental forces. That is, excepting for occasional qualifications restricting the application of particular agreements, there has been a general tendency for the governments to accept the fares and rates decided by their airlines in their conferences.

While governments typically approve the terms negotiated by their airlines at these IATA Traffic Conferences, arriving at a decision that is mutually acceptable to all the airlines in a conference is a difficult and time-consuming process which sometimes approach crisis proportions. Such difficulty arises from the plethora of rate-related issues on which agreement must be reached, and the need to reconcile widely divergent positions of many airlines on some of these issues. For instance, agreement must be reached on such matters as group inclusive tour regulations, seasonal packages, new city pairs, excursion fares, and in-flight services such as movies.

Presumably, airlines seeking to maximize profits bargain (at IATA Traffic Conferences) for a rate structure based on their own cost and demand schedules. This makes it more difficult to reach an agreement, given the wide variations that often exist in the cost and demand situations facing different airlines. Thus the larger, established and more efficient airlines with lower unit costs are likely to bargain for lower fares than the relatively small, young and inefficient airlines.

A criterion of efficiency is that of a market determined price based on the cost of providing the service. Marginal cost pricing would require for instance that the level of fares be reduced as cost declines with increasing stage lengths and higher route densities. While air fares exhibited a downward trend over much of the last two and a half decades, fare reductions have not truly reflected the lower costs associated with longer stage lengths and higher traffic density on some routes. Instead, the IATA rate-setting process reflects a value-of-service pricing system based on the intensity of demand for the service. Such a pricing system is synonymous with the policy of charging what the traffic will bear—a policy that connotes monopolistic pricing behavior.<sup>11</sup>

This formal fixing of prices by I.A.T.A. airlines can easily be interpreted as an approximation to a cartel. With this interpretation is likely to come the indictment of an artificially elevated rate structure characteristic of monopolistic efforts to maximize profits. This suggests that the economic performance of the international airline industry is impaired, as fares are likely to be kept higher than a more competitive situation suggests. This possible result can be translated into traffic volume, for it has already been indicated that the lower the fare level, the larger will be the volume of traffic generated.

One might also expect that there will be a temptation for individual airlines to dishonor the "cartel" agreement and charge fares lower than the agreed level in the hope of attracting traffic such that its profit position is enhanced. I.A.T.A. does attempt to achieve a monolithic adherence to price agreements through its provisions for penalty to dissenters. However, such subtle discounts as the allowance of excess baggage are not readily detected. Further, rate agreements through I.A.T.A. Traffic Conferences may be partly frustrated by non-IATA airlines (e.g., Icelandic Airlines) operating in the market. These forces tend to weaken any monopoly power of the IATA pricing machinery, and thus the possible impact on traffic volume might not be as restrictive as a first approximation suggests.

The regulation of air fares has been defended and attacked from time to time, and still remains a polemic issue. However, from the viewpoint of traffic growth the arguments against regulation are more convincing than those for it.<sup>12</sup> These anti-regulation arguments suggest that the fixing of rates by IATA is not conducive to maximum generation of traffic, since it tends to maintain fares at a level higher than would be obtained under a system of freely competitive pricing. This higher level of fares is condoned by many governments and airlines since it protects many carriers that would possibly succumb to more competitive and lower prices. Prices also tend to be more rigid than would be obtained under a more competitive situation, for most cartel-like arrangements are characterized by difficulties in arriving at decisions which are mutually satisfactory to all its participants. Thus when an agreement is reached, there will be some reluctance to try and alter it subsequently.

In the absence of fare regulation, competitive and flexible pricing should give rise to lower air fares capable of generating large volumes of traffic. This would also help to ensure that only the most efficient airlines survive, charging fares which approximate their average cost of operation. This low fare level would cause the relatively high-cost inefficient airlines to be priced out of the market unless subsidized. Only when fares are depressed to the lowest possible level consistent with average cost can traffic growth be expected to reach its maximum, assuming that other things such as the "tourist climate" in the host countries remain constant or improve.

Besides reducing fares, more competition in the air transport industry would also mean greater "product" differentiation instead of product homogeneity (paradoxically). That is, a greater variety of aircraft equipment and cabin service would presumably result in lower fares being charged for the less sophisticated passenger service. This could conceivably generate many more tourists of modest economic

circumstances. It could also ease the economically wasteful equipment competition from which the industry now suffers, thereby reducing cost, lowering fares and increasing traffic.

### The Role of Charter Service

The development of charter service outside of the IATA system has been an important challenge to the rate-fixing machinery discussed above. In an effort to curb this development IATA has tried<sup>13</sup> unsuccessfully to bring charter carriers under its jurisdiction. The co-existence of charter carriers and IATA scheduled carriers as "enemies" has resulted in some erosion of the IATA rate structure. In many instances,<sup>14</sup> IATA has responded to the charter challenge by the implementation of group inclusive tours at fares comparable to those charged by charter carriers, as well as by some downward adjustment of its basic fare level.

The IATA group fares have been relatively low compared to the basic fares offered to passengers who travel on an individual basis. This can be explained in part by IATA's effort to compete with the low group fares offered by charter carriers, and in part by different demand elasticities of the group traveler and the individual traveler. Because of the group and time constraints placed on charter arrangements, travel on this basis is more likely to be of the pleasure type and hence characterized by relatively high demand elasticity. By contrast, individual travel especially for business purposes will have a less elastic demand for air transport. Even if the individual traveler plans a pleasure trip, he may prefer a somewhat flexible schedule and would therefore not find the regimentation of charter arrangement convenient. Thus for him the demand for air travel would also be less elastic than that of his charter counterpart.<sup>15</sup>

Given these separate markets (i.e., individual and group) with different elasticities, it is possible for IATA as a rate-fixing agency with monopoly or quasi-monopoly power to maintain its discriminatory pricing categories of travelers even



though they travel on the same aircraft and have the same points of origin and destination. When used to extend the market (generate demand), price discrimination might be considered desirable in that it makes the good or service available to the consumer who might have been deprived of same if it were sold on a single price basis. This is true of air transport and IATA's discriminatory pricing, in that IATA's relatively low group fares which have been induced by competition from charter service have contributed to the generation of "new" air traffic.

This point leads to an important question regarding the challenge that charter carriers pose to IATA scheduled carriers. The concern here is whether charters generate new traffic or merely competes away traffic from scheduled carriers. Obviously, the scheduled carriers like to make the latter charge. However, there is convincing empirical evidence<sup>16</sup> to show that scheduled and charter services cater to different traffic markets, and that the two are complementary rather than competitive in stimulating the growth of total air traffic. As indicated earlier, the charter carriers cater to group travel while the scheduled carriers are characterized mainly by individual travel. The evidence further indicates that for the most part charter passengers would not travel by scheduled service if charters were not available.

Further, there are indications that scheduled carriers have benefited from the market innovations of charter service. Thus "when in 1959 the scheduled services were permitted by IATA regulations (Resolution 084 h) to offer inclusive tour prices with reductions in fares closely approaching those of inclusive tour services, they seem to have quickly developed new traffic of their own without seriously affecting the traffic of the inclusive tour services which continued to expand although at a somewhat reduced rate."<sup>17</sup>

Tables IV-2 and IV-3 suggest that (with few exceptions) the growth of charter traffic does not preclude the growth of scheduled traffic. One might ask whether



the latter might not have grown even faster in the absence of charter carriers. The answer seems to be in the negative for as surveys<sup>18</sup> reveal, the great majority of charter passengers would not have travelled if charters were not available. The data for 1969 (Table IV-2) are particularly illuminating. In that year IATA scheduled traffic increased by approximately 15 percent over 1968, and this increase closely approximated the average annual increase of 15.7 percent over the preceding ten years. By contrast, charter traffic in 1969 increased by 107.5 percent over the previous year. These percentage increases suggest that the growth rate of IATA scheduled traffic in 1969 would have been much less if the more than doubling of charter traffic in that year were achieved by competing away scheduled traffic. This reinforces the earlier observation that both types of service are not conflicting in the generation of traffic.

The preceding discussion suggests that the development of charter service can give rise to an increase in the quantity of air transport demanded per period of time. That is, the lower group fares offered by both charter carriers and IATA scheduled carriers will attract new traffic that would not otherwise use air transport, and may at the same time induce some persons to increase the total number of trips they take per year. Any competitive spur by charter carriers which leads to a reduction of the basic fare level by IATA scheduled carriers would further contribute to these results. Thus the development of charter service can be credited with the expansion of air traffic both inside and outside of the regulated bounds of IATA.

Charter traffic has accounted for only a small fraction of air traffic to the Caribbean. For instance, during the years 1966 and 1967 charter traffic was just about one percent of air arrivals in Jamaica.<sup>19</sup> By contrast, charter traffic was 19 percent of scheduled traffic in the North Atlantic in 1967.<sup>20</sup> One possible explanation for the low charter activity in the Caribbean is the relative proximity

TABLE IV-2

ANNUAL PERCENTAGE GROWTH IN TRANS-ATLANTIC TRAFFIC  
SHOWING ABSENCE OF INTERDEPENDENCY OF GROWTH  
TRENDS, 1959 - 1973.\*

| Year  | Percentage Change from Prior Year in: |                                        |                                                |               |
|-------|---------------------------------------|----------------------------------------|------------------------------------------------|---------------|
|       | IATA<br>Scheduled<br>Traffic          | U.S. Supplementals,<br>Charter Traffic | Direction (+ or -) of<br>Change in Growth Rate |               |
|       |                                       |                                        | IATA                                           | Supplementals |
| 1959  | 14.1                                  | 4.3                                    |                                                |               |
| 1960  | 27.4                                  | 7.8                                    | +                                              | +             |
| 1961  | 7.8                                   | 66.8                                   | -                                              | +             |
| 1962  | 19.8                                  | 31.2                                   | +                                              | -             |
| 1963  | 9.2                                   | 35.1                                   | -                                              | +             |
| 1964  | 28.6                                  | 79.9                                   | +                                              | +             |
| 1965  | 16.2                                  | 47.5                                   | -                                              | -             |
| 1966  | 14.4                                  | 65.0                                   | -                                              | +             |
| 1967  | 16.7                                  | 72.8                                   | +                                              | +             |
| 1968  | 6.1                                   | 31.0                                   | -                                              | -             |
| 1969  | 14.9                                  | 107.5                                  | +                                              | +             |
| 1970  | 20.0                                  | 38.5                                   | +                                              | -             |
| 1971  | 4.2                                   | 15.8                                   | -                                              | -             |
| 1972  | 26.7                                  | 0.8                                    | +                                              | -             |
| 1973* | 5.3                                   | 2.2                                    | -                                              | +             |

Source: Brian A. Cooke, Tourism and Air Transport, 4th ITA (International Air Transport), International Symposium, Paris, November 1970, p. 20; and International Civil Aviation Organization, A Review of the Economic Situation of Air Transport, Circular 122-AT/32, 1974, pp. 24 and 60.

\*For additional and more recent data see Table IV-3.

TABLE IV-3

NON-SCHEDULED AND SCHEDULED PASSENGER TRAFFIC,  
NORTH ATLANTIC, 1969-1980.

| Year | Non-Scheduled<br>(Non-IATA)<br>Traffic |                   | Scheduled<br>(IATA)<br>Traffic |                   |
|------|----------------------------------------|-------------------|--------------------------------|-------------------|
|      | Number<br>(000's)                      | Percent<br>Change | Number<br>(000's)              | Percent<br>Change |
| 1969 | 1411                                   | -                 | 6000                           | -                 |
| 1970 | 1684                                   | 29.3              | 7200                           | 20.0              |
| 1971 | 2181                                   | 29.3              | 7500                           | 4.2               |
| 1972 | 1976                                   | -9.4              | 9500                           | 26.7              |
| 1973 | 2013                                   | 1.9               | 10000                          | 5.3               |
| 1974 | 1992                                   | -1.0              | 9300                           | -7.0              |
| 1975 | 1954                                   | -1.9              | 8800                           | -5.4              |
| 1976 | 2018                                   | 3.3               | 9800                           | 11.4              |
| 1977 | 2818                                   | 39.6              | 10300                          | 5.1               |
| 1978 | 2483                                   | -11.9             | 12600                          | 22.3              |
| 1979 | -                                      | -                 | 13200                          | 4.8               |
| 1980 | -                                      | -                 | 14140                          | 7.1               |

Source: International Civil Aviation Organization, A Review of the Economic Situation of Air Transport 1969-1979, Circular 158-AT/57, 1980, pp. 23 and 60.

of the islands to the tourist-generating countries of the United States and Canada, and the corresponding low fares on scheduled carriers to these Caribbean destinations compared to scheduled fares for more distant (example Trans-Atlantic) trips.<sup>21</sup> That is, the North American tourist might find charter travel with its group and time constraints less attractive if he is Caribbean bound, than if he were going to Europe; for in the latter case, the relatively high cost by a scheduled carrier may give the lower fare of charter arrangements greater appeal.

But although charter traffic to the area has been of little significance, the Caribbean like other markets has perhaps experienced some spillover effects from the competitive pressure imposed on the IATA rate structure by charter carriers. This pressure, it was shown earlier, has motivated IATA to reduce the basic fare levels of its scheduled carriers, and such fare reductions have the ability to generate scheduled traffic of a tourist nature, in accordance with the demand elasticity previously discussed.

The resulting rate structure in the industry has implications for the growth of traffic to Jamaica vis a vis traffic to competing destinations, through what might be termed "distance taper." It is conceivable that as the passenger cost of travelling further distances declines relatively, Jamaica could lose some of its advantage of proximity to North America in terms of attracting tourist traffic. That is, if the additional cost of going beyond Jamaica to a more distant location in the Caribbean is relatively low, this could lure some potential visitors away from Jamaica to other Caribbean destinations. This attraction is likely to be even greater for those tourists who originate further away from the Caribbean because, for them, the additional cost would be a smaller percentage of the fare to Jamaica as illustrated below.

Compare, for example, the recent fare structure<sup>22</sup> between Jamaica and some major cities in the eastern part of North America with that between Trinidad

and the same cities. It should be noted that Trinidad which is approximately 825 miles southeast of Jamaica is the Caribbean island that is furthest to the south of North America. For the dates examined, the fare between Miami and Trinidad was 127 percent higher than that between Miami and Jamaica. Between New York and Trinidad the fare was 35 percent higher than the New York-Jamaica fare; and the fare between Toronto and Trinidad was 19 percent higher than that between Toronto and Jamaica. Miami, New York and Toronto are approximately 350, 1440 and 1806 miles from Jamaica respectively.

Stated alternatively, the cost per mile to the tourist of travelling the extra 825 miles if he chose to visit Trinidad instead of Jamaica would be 21.9 cents if he came from Miami, 11.4 cents from New York and 9.2 cents from Toronto. It is seen therefore that the tourist originating from the furthest distance, (Toronto in this case) would have the greatest fare advantage in choosing Trinidad over Jamaica as his vacation destination. For more fare and distance details see Tables IV-4 and IV-5. The relationship between fare and distance was also investigated in terms of fare per mile between the three North American cities mentioned above and various Caribbean destinations. While that relationship did not exhibit a consistent pattern, the data did show that for every Caribbean location more distant than Jamaica, the cost per mile of getting there was lower than that of going to Jamaica.

The above discussion and example suggest that there is some "economies of distance" to the air traveler going to the Caribbean; that is, it costs relatively less to travel longer distances. This tends to make the further location more attractive from the standpoint of travel cost, and brings it closer within the reach of the potential tourist. One would expect this "distance taper" to be even sharper with charter fares than with the scheduled fares used in the above example. That is, the cost advantage associated with distance will be greater with charter fares which



TABLE IV-4

AIR FARES BETWEEN NORTH AMERICAN CITIES  
AND CARIBBEAN DESTINATIONS,  
NOVEMBER 1, 1983

| One-Way Economy Air Fare |       |          |         |
|--------------------------|-------|----------|---------|
|                          | Miami | New York | Toronto |
| Antigua                  | \$202 | \$272    | \$377   |
| Bahamas                  | 52    | 198      | 271     |
| Barbados                 | 299   | 326      | 447     |
| Cayman Islands           | 115   | 235      | 244     |
| Grenada                  | 293   | 329      | 441     |
| Haiti                    | 148   | 228      | 406     |
| Jamaica                  | 143   | 266      | 396     |
| Puerto Rico              | 179   | 239      | 301     |
| St. Lucia                | 271   | 326      | 469     |
| St. Thomas               | 215   | 270      | 293     |
| Trinidad                 | 324   | 360      | 472     |

Source: The Dun and Bradstreet Corporation, Official Airline Guide, North American Edition, November 1, 1983.

TABLE IV-5

APPROXIMATE DISTANCES BETWEEN NORTH AMERICAN  
CITIES AND CARIBBEAN DESTINATIONS

|                | Approximate Mileage |          |         |
|----------------|---------------------|----------|---------|
|                | Miami               | New York | Toronto |
| Antigua        | 925                 | 2015     | 2381    |
| Bahamas        | 225                 | 1315     | 1681    |
| Barbados       | 1050                | 2140     | 2506    |
| Cayman Islands | 450                 | 1540     | 1906    |
| Grenada        | 995                 | 2085     | 2451    |
| Haiti          | 510                 | 1600     | 1966    |
| Jamaica        | 350                 | 1440     | 1806    |
| Puerto Rico    | 710                 | 1800     | 2166    |
| St. Lucia      | 975                 | 2065     | 2431    |
| St. Thomas     | 825                 | 1915     | 2281    |
| Trinidad       | 1175                | 2265     | 2631    |

Source: Estimates made by author from air mileage chart published by The Dun and Bradstreet Corporation, Official Airline Guide, North American Edition, and a map of the Caribbean Islands.



are relatively low, and tourists will therefore tend to travel even further under charter arrangements.

Thus as fares decline in relative terms, the number of tourist destinations increases. This tends to put the more proximate location like Jamaica at a competitive disadvantage in terms of the number of tourist arrivals. While Jamaica apparently once enjoyed much advantage from its proximity to North America, as evidenced by the relatively rapid growth of tourism during the years of cruise ship dominance, and the earlier years of air transport development (see Chapters V and VI), it now stands to lose from the distance taper indicated above. That is, it now faces greater inter-destinational competition which tends to erode its share of the traffic to the Caribbean. There is some indication that this has already been happening as seen below.

Examination of the data in Table IV-7 reveals that excepting for two years (1969 and 1970) of moderate decline, Jamaica's share of traffic to the Caribbean increased annually over the period 1964-1974. However, since then, its share has steadily declined from its highest level of 11.6 percent (in 1974) to 6.7 percent in 1980. The share of traffic lost by Jamaica has been distributed over several other islands, but it is of interest to note that Haiti and particularly Barbados which are more distant than Jamaica from the main source of tourists (that is, North America), have both shown steady gains in the percentage of tourist traffic received since 1974. In addition, Trinidad and Grenada, two other relatively distant islands have both experienced overall increases in their shares since 1974.

TABLE IV-6  
TOURIST ARRIVALS IN SELECTED CARIBBEAN COUNTRIES, 1960-1980

| Year | Countries and Number of Arrivals |          |         |         |       |         |             |          |
|------|----------------------------------|----------|---------|---------|-------|---------|-------------|----------|
|      | Bahamas                          | Barbados | Bermuda | Grenada | Haiti | Jamaica | Puerto Rico | Trinidad |
|      | (Thousands of Arrivals)          |          |         |         |       |         |             |          |
| 1960 | 305.6                            | 35.5     | 111.3   | 6.8     | 79.3  | 80.4    | 540.4       | 73.8     |
| 1961 | 314.1                            | 37.1     | 123.6   | 7.9     | 91.3  | 76.0    | 667.1       | 70.6     |
| 1962 | 336.0                            | 44.3     | 133.3   | 9.0     | 17.2  | 78.5    | 796.2       | 70.4     |
| 1963 | 398.7                            | 50.6     | 141.6   | 10.4    | 46.8  | 80.9    | 925.9       | 72.0     |
| 1964 | 399.9                            | 57.6     | 189.0   | 12.0    | 19.4  | 97.3    | 1072.0      | 93.1     |
| 1965 | 720.4                            | 68.4     | 187.3   | 13.8    | 20.6  | 160.3   | 1254.3      | 59.2     |
| 1966 | 822.3                            | 79.1     | 210.6   | 18.1    | 12.4  | 209.5   | 1367.2      | 67.7     |
| 1967 | 915.3                            | 91.6     | 237.2   | 20.5    | 15.0  | 213.3   | 809.4       | 79.0     |
| 1968 | 1072.2                           | 115.7    | 267.4   | 23.2    | 18.2  | 258.2   | 946.5       | 91.7     |
| 1969 | 1332.4                           | 131.9    | 281.0   | 29.6    | 21.9  | 277.8   | 1007.4      | 95.6     |
| 1970 | 1298.3                           | 147.2    | 302.8   | 30.4    | 26.6  | 295.2   | 1121.3      | 99.4     |
| 1971 | 1396.6                           | 163.4    | 319.3   | 30.8    | 32.2  | 340.0   | 1208.6      | 105.4    |
| 1972 | 1443.4                           | 184.4    | 343.2   | 31.6    | 67.6  | 365.3   | 1349.5      | 114.6    |
| 1973 | 976.8                            | 198.6    | 369.0   | 32.5    | 43.0  | 373.4   | 1398.3      | 125.6    |
| 1974 | 929.2                            | 210.8    | 511.4   | 14.7    | 47.6  | 433.0   | 1441.0      | 129.0    |
| 1975 | 903.1                            | 221.6    | 511.4   | 21.1    | 79.2  | 395.8   | 1339.1      | 132.6    |
| 1976 | 939.9                            | 224.3    | 558.9   | 24.5    | 85.9  | 327.7   | 1298.7      | 158.7    |
| 1977 | 965.4                            | 268.8    | 572.9   | 28.5    | 95.0  | 310.6   | 1474.3      | 167.2    |
| 1978 | 1176.1                           | 316.3    | 551.5   | 32.3    | 112.0 | 343.4   | 1662.0      | 190.0    |
| 1979 | 1311.4                           | 371.9    | 565.3   | 36.5    | 132.2 | 374.1   | 1878.1      | 216.6    |
| 1980 | 1455.6                           | 437.4    | 579.4   | 41.2    | 155.9 | 359.3   | 2122.2      | 244.8    |

Source: United Nations, Statistical Yearbook (Various Issues); National Planning Agency, Economic and Social Survey of Jamaica (Various Issues); Reports of the Islands' Tourist Boards; and estimates made by author. 88

TABLE IV-7  
PERCENTAGE DISTRIBUTION OF TOURIST ARRIVALS IN  
CARIBBEAN COUNTRIES, 1960-1980

| Year | Countries and Percent of Arrivals |          |         |         |       |         |             |          | Total <sup>a</sup> |
|------|-----------------------------------|----------|---------|---------|-------|---------|-------------|----------|--------------------|
|      | Bahamas                           | Barbados | Bermuda | Grenada | Haiti | Jamaica | Puerto Rico | Trinidad |                    |
|      | (Percent)                         |          |         |         |       |         |             |          |                    |
| 1960 | 24.8                              | 2.9      | 9.0     | 0.6     | 6.4   | 6.5     | 43.8        | 6.0      | 100                |
| 1961 | 22.6                              | 2.7      | 8.9     | 0.6     | 6.6   | 5.5     | 48.1        | 5.1      | 100                |
| 1962 | 22.6                              | 3.0      | 9.0     | 0.6     | 1.2   | 5.2     | 53.6        | 4.7      | 100                |
| 1963 | 23.1                              | 2.9      | 8.2     | 0.6     | 2.7   | 4.7     | 53.6        | 4.2      | 100                |
| 1964 | 20.6                              | 3.0      | 9.7     | 0.6     | 1.0   | 5.0     | 55.2        | 4.8      | 100                |
| 1965 | 29.0                              | 2.8      | 7.5     | 0.6     | 1.0   | 6.4     | 50.5        | 2.4      | 100                |
| 1966 | 29.5                              | 2.8      | 7.6     | 0.6     | 0.4   | 7.5     | 49.1        | 2.4      | 100                |
| 1967 | 38.4                              | 3.8      | 10.0    | 0.9     | 1.0   | 8.9     | 34.0        | 3.3      | 100                |
| 1968 | 38.4                              | 4.1      | 9.6     | 0.8     | 0.7   | 9.2     | 33.9        | 3.3      | 100                |
| 1969 | 41.9                              | 4.2      | 8.8     | 0.9     | 0.7   | 8.7     | 31.7        | 3.0      | 100                |
| 1970 | 39.1                              | 4.4      | 9.1     | 0.9     | 0.8   | 8.8     | 33.8        | 3.0      | 100                |
| 1971 | 38.8                              | 4.5      | 8.9     | 0.9     | 0.9   | 9.4     | 33.6        | 2.9      | 100                |
| 1972 | 37.0                              | 4.7      | 8.8     | 0.8     | 1.7   | 9.4     | 34.6        | 2.9      | 100                |
| 1973 | 27.8                              | 5.6      | 10.5    | 0.9     | 1.2   | 10.6    | 39.8        | 3.6      | 100                |
| 1974 | 25.0                              | 5.7      | 13.8    | 0.4     | 1.3   | 11.6    | 38.8        | 3.5      | 100                |
| 1975 | 25.1                              | 6.1      | 14.2    | 0.6     | 2.2   | 11.0    | 37.2        | 3.7      | 100                |
| 1976 | 26.0                              | 6.2      | 15.4    | 0.7     | 2.4   | 9.0     | 35.9        | 4.4      | 100                |
| 1977 | 24.9                              | 6.9      | 14.8    | 0.7     | 2.4   | 8.0     | 38.0        | 4.3      | 100                |
| 1978 | 26.8                              | 7.2      | 12.6    | 0.7     | 2.6   | 7.8     | 37.9        | 4.3      | 100                |
| 1979 | 26.8                              | 7.6      | 11.6    | 0.7     | 2.7   | 7.6     | 38.4        | 4.4      | 100                |
| 1980 | 27.0                              | 8.1      | 10.7    | 0.8     | 2.9   | 6.7     | 39.3        | 4.5      | 100                |

Source: Table IV-6

Note: <sup>a</sup>Percentages may not add up to 100 because of rounding.

## CHAPTER IV

## NOTES

1. Capital-output ratios of the industry have risen from about 0.60 during the pre-jet era (1950) to about 1.0 in recent years among firms that operate mostly jet aircraft. Also, the difference in the absolute cost of piston-engine aircraft and jet aircraft is quite large. For instance, while the Boeing 707 is approximately four times as productive as the DC-7, the former has a capital requirement of about twenty-five times that of the latter. See Mahlon R. Straszheim, *op. cit.*, pp. 101 and 104.
2. Jamaica entered into a 1968 agreement whereby her national airline - Air Jamaica would receive assistance from Air Canada according to the following terms.
  - a. Common stock equivalent to \$1 million Canadian to be purchased 60 percent by the Government of Jamaica, and 40 percent by Air Canada.
  - b. Redeemable preferred stock equivalent to a maximum of \$8 million Canadian to be purchased by Air Canada to the extent required for the acquisition of equipment. The Government of Jamaica will purchase this stock from Air Canada over a period of 10 years at a premium equivalent to 7 3/4 percent per annum.

In addition, initial managerial and technical assistance was to be provided to Air Jamaica by Air Canada. See Air Canada, Annual Report 1968, p. 20.

3. Mahlon R. Straszheim, *op. cit.*, p. 72.
4. Such exclusion may be based on political or other noneconomic grounds. For instance, differences in the political ideology of the two nations may preclude a bilateral air transport agreement between them.
5. Fifth freedom privileges permit a carrier leaving its own country - country A, and destined for country D, to put down and pick up passengers in "intermediate" countries B and C. Similarly, on its return home, it may transport passengers on any leg of the route whether or not they are destined for its country. The carrier of country D would be afforded comparable privilege to transport passengers on intermediate route segments. However, the execution of fifth freedom privileges necessitate negotiations with intermediate countries such as B and C. These countries in the economic interest of their own carriers may grant only limited access to fifth freedom traffic, and this could inhibit traffic growth for several reasons. For instance, the restriction or elimination of intermediate stops and fifth freedom traffic may necessitate nonstop flights between the country of origin and the country of destination. Although this may have appeal to passengers, and cost appeal to airlines, on long-haul routes of low traffic density the number of passengers demanding this service might be so small as to give rise to large "excess capacity" of aircraft and/or the unavailability of frequent flights. Passengers requiring air transportation between such infrequent flights may have to

resort to service characterized by a change of carrier on each segment of the route where the carriers of each pair of countries involved would be operating. This transfer from one carrier to another could have a negative impact on demand and limit the flow of traffic between the two countries at the ends of the route.

6. Mahlon R. Straszheim, op. cit., pp. 35-36.
7. Passengers carried by the airlines would be a preferred measure, but the available data at this writing do not permit the use of that measure. The available passenger data are aggregated by regions; similarly data on passengers carried by individual airlines are available for all of their operations as opposed to operation on specific routes.
8. R. H. Donnelley Corporation, Official Airline Guide (Oakbrook, Illinois), December 1981.
9. Given the price-elastic character of the tourist demand for air transport observed earlier, this increase in fares by the large airline could be expected to decrease its total revenue. But this would only happen if the fare increase caused a proportionately larger decrease in the number of seats sold by this airline. However, this is not likely, for the large airline would now have the entire market to itself, so that despite its higher price it will be able to pick up some of the traffic lost by the smaller airline which has been squeezed out of the market. It is therefore possible that traffic volume to the large airline could increase although it declines for that particular market.
10. Recall the earlier discussion that excepting for bilateral arrangements entry is relatively easy.
11. See Mahlon R. Straszheim, op. cit., pp. 141-149 and H. Peter Gray, op. cit., pp. 179-193.
12. For an example of the pro-regulation arguments see Stephen Wheatcroft, Air Transport Policy, Michael Joseph Ltd., London, 1964, pp. 80-85. Opposing arguments are presented in Mahlon R. Straszheim, op. cit., pp. 195-196, and K. G. J. Pillai, The Air Net, Grossman Publishers, New York, 1969, pp. 36-38.
13. For a discussion of the methods used, see K. G. J. Pillai, op. cit., Chapter 10.
14. Ibid., pp. 170-175.
15. Cf. H. Peter Gray, International Travel-International Trade, D. C. Heath and Company, Lexington, Massachusetts, 1970, p. 191.
16. See for example Brian A. Cooke, Tourism and Air Transport, 4th ITA (International Air Transport), International Symposium, Paris, November 1970, p. 19, and Stephen Wheatcroft, op. cit., p. 33.
17. International Civil Aviation Organization, Inclusive Tour Services in International Air Transport, Document 8244-AT/717, p. 10.
18. Ibid., pp. 14-18.



19. Derived from data given by The Jamaican Tourist Board, Travel Statistics—Jamaica, 1967 (mimeographed).
20. K. G. J. Pillai, op. cit., p. 166.
21. As an example take the New York-Jamaica economy fare which is only about 50 percent of the New York-London economy fare for the same time limit.
22. See The Dun and Bradstreet Corporation, Official Airline Guide, North American Edition, November 1, 1983.

## CHAPTER V

### THE FUTURE GROWTH OF AIR TRAFFIC TO JAMAICA

The last three chapters examined factors which have contributed to the past growth of air traffic to Jamaica. Using the analysis and the findings of those chapters, this chapter will investigate the future growth of tourist traffic to Jamaica, and some of the developments responsible for the projected growth trend.

#### The Framework

The technique employed by this study involves forecasting the future development of the independent variables included in the demand model of Chapter III (see Equation III-1), then using the projected values of these variables to forecast the dependent variable. The projected values of the independent variables were derived through simple trend projection (of real disposable income and real air fare); therefore in interpreting the results of the final forecast the usual caveat regarding the limitations and danger of such simple extrapolation should be heeded. Further details are provided below.

A plot of the data for real disposable income per capita and real air fare over the study period (see Chapter III), together with freehand sketch lines was used initially to approximate the trend of these two variables. Real per capita disposable income has been rising steadily over time and correspondingly the sketch line for that variable reflects a consistent upward linear trend. On the other hand, air fare has undergone some fluctuations with the line of best fit to the data approximating a second-degree parabola that declines to a turning point then rises.

Given the above observations, a linear trend equation for income and a quadratic trend equation for air fare will be employed below. These equations are of



the following forms:

$$Y_c = b_0 + b_1 X \quad (V-1)$$

$$\text{and } Y_c = b_0 + b_1 X + b_2 X^2 \quad (V-2)$$

The corresponding estimating equations fitted by means of the least squares technique will be presented below.

The projected trend values of the independent variables thus derived were compared with the values of those variables in 1981 (the most recent year included in this study), in order to estimate their annual percentage rates of growth over the forecast period. These percentages were then substituted into the estimating demand equation of Chapter III to derive the forecasted rate of growth of the dependent variable. That is, in terms of Equation III-2 the projected rate of growth of traffic is estimated by the equation:

$$d \log T = 2.2266 d \log Y - 1.4723 d \log P \quad (V-3)$$

where  $d \log Y$  and  $d \log P$  are the projected percentage rates of growth of real disposable income per capita and real air fare respectively.

Two forecasts of different time frames will be offered below. One is for a five-year period ending in 1986 and may be considered an "intermediate" term forecast; the other is long-term and covers a ten-year period ending in 1991. Given the underlying assumption of simple trend extrapolation that the pattern identified will continue in the future, and given the increasing risk as values of the independent variables are projected further into the future, the ten-year forecast should be regarded as only very tentative and should be revised later if future developments so dictate.

### Results of the Analysis

Following the procedure outlined above, the trend equations for disposable income per capita and for air fare were fitted to produce the following:

$$Y_c = 3616.72 + 49.11X \quad (V-4)$$

$$P_c = 255 - 2.2459X + 0.0789X^2 \quad (V-5)$$

where  $Y_c$  and  $P_c$  are trend values for income and fare respectively, and  $X$  is a time variable measured in years. In order to get some indication of the predictive ability of these two trend equations, annual trend values of income and fare were computed and compared with their corresponding historical values, (see Tables V-1 and V-2, and Figures V-1 and V-2). In both instances these equations produced trend values that are on the average less than one percent above the actual values. The mean percentage error is only 0.06 percent in the case of income and 0.83 percent for the air fare comparisons, (Tables V-1 and V-2).

The trend equation for income produced trend values of \$5139 in 1986 and \$5630 in 1991 for disposable income per capita. These values correspond to annual growth rates of 2.02 percent from 1981 to 1986, and 1.93 percent from 1981 to 1991. The 95 percent confidence intervals for these growth rates are:  $1.34\% \angle 2.02\% \angle 2.69\%$  and  $1.60\% \angle 1.93\% \angle 2.26\%$ .

Similarly, the trend equation for fare produced trend values of \$261.20 in 1986 and \$295.60 in 1991 for air fare. The corresponding annual growth rates are 1.48 percent between 1981 and 1986, and 1.99 percent between 1981 and 1991. The 95 percent confidence intervals for these growth rates are:  $-0.80\% \angle 1.48\% \angle 3.76\%$ , and  $0.85\% \angle 1.99\% \angle 3.13\%$ . These results are summarized in Table V-3.

The substitution of these growth rates of income and air fare into Equation V-3 indicates that traffic will grow at annual rates of 2.32 percent to 1986 and 1.37 percent to 1991. That is with income increasing at 2.02 percent and air fare increasing at 1.48 percent per year, the growth rate of traffic between 1981 and 1986 would be:

$$d \log T = 2.2266 (2.02) - 1.4723 (1.48) = 2.32\% \quad (V-6)$$

TABLE V-1

ACTUAL AND TREND VALUES OF REAL DISPOSABLE INCOME  
PER CAPITA IN NORTH AMERICA, 1960-1981.

| Year | <u>Income</u>            |           | Residual | Percentage<br>Error |
|------|--------------------------|-----------|----------|---------------------|
|      | Actual<br>(1972 Dollars) | Predicted |          |                     |
| 1960 | 2614                     | 2585      | +29      | +1.11               |
| 1961 | 2637                     | 2684      | -47      | -1.78               |
| 1962 | 2708                     | 2782      | -74      | -2.73               |
| 1963 | 2764                     | 2880      | -116     | -4.20               |
| 1964 | 2916                     | 2978      | -62      | -2.13               |
| 1965 | 3112                     | 3076      | +36      | +1.16               |
| 1966 | 3236                     | 3175      | +61      | +1.88               |
| 1967 | 3326                     | 3273      | +53      | +1.59               |
| 1968 | 3421                     | 3371      | +50      | +1.46               |
| 1969 | 3482                     | 3469      | +13      | +0.37               |
| 1970 | 3577                     | 3568      | +9       | +0.25               |
| 1971 | 3675                     | 3666      | +9       | +0.24               |
| 1972 | 3809                     | 3764      | +45      | +1.18               |
| 1973 | 4036                     | 3862      | +174     | +4.31               |
| 1974 | 3965                     | 3960      | +5       | +0.13               |
| 1975 | 4016                     | 4059      | -43      | -1.07               |
| 1976 | 4129                     | 4156      | -27      | -0.65               |
| 1977 | 4270                     | 4254      | +16      | +0.37               |
| 1978 | 4430                     | 4353      | +77      | +1.74               |
| 1979 | 4473                     | 4452      | +21      | +0.47               |
| 1980 | 4454                     | 4550      | -96      | -2.16               |
| 1981 | 4518                     | 4648      | -130     | -2.88               |

Source: Table III-1 and Equation V-1.

TABLE V-2

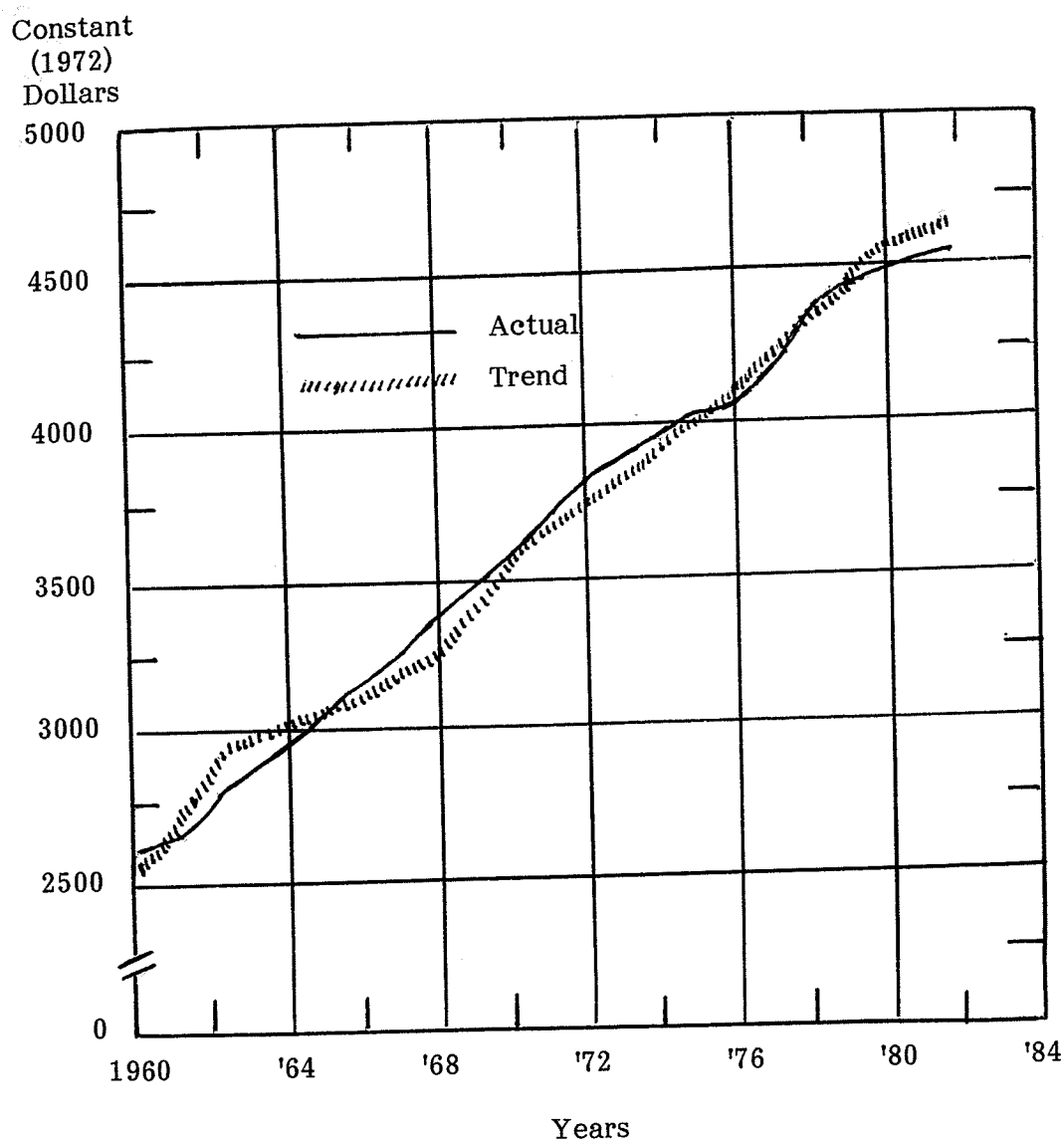
ACTUAL AND TREND VALUES OF AIR FARE TO JAMAICA,  
WEST INDIES FROM NORTH AMERICA,\* 1960-1981.

| Year | <u>Air Fare</u>          |           | Residual | Percentage<br>Error |
|------|--------------------------|-----------|----------|---------------------|
|      | Actual<br>(1972 Dollars) | Predicted |          |                     |
| 1960 | 285                      | 336.95    | -51.95   | -18.22              |
| 1961 | 296                      | 326.15    | -30.15   | -10.18              |
| 1962 | 306                      | 315.98    | - 9.98   | - 3.26              |
| 1963 | 437                      | 306.44    | +130.56  | +29.75              |
| 1964 | 297                      | 297.53    | - 0.53   | - 0.18              |
| 1965 | 292                      | 289.24    | + 2.76   | + 0.94              |
| 1966 | 284                      | 281.60    | + 2.40   | + 0.84              |
| 1967 | 277                      | 274.59    | + 2.41   | + 0.87              |
| 1968 | 266                      | 268.20    | - 2.20   | - 0.83              |
| 1969 | 254                      | 262.45    | - 8.45   | - 3.33              |
| 1970 | 251                      | 257.32    | - 6.32   | - 2.52              |
| 1971 | 246                      | 252.83    | - 6.83   | - 2.78              |
| 1972 | 250                      | 248.97    | + 1.03   | + 0.41              |
| 1973 | 244                      | 245.74    | - 1.74   | - 0.71              |
| 1974 | 227                      | 243.15    | -16.15   | - 7.11              |
| 1975 | 225                      | 241.18    | -16.18   | - 7.19              |
| 1976 | 230                      | 239.85    | - 9.85   | - 4.28              |
| 1977 | 234                      | 239.13    | - 5.13   | - 2.19              |
| 1978 | 239                      | 239.06    | - 0.06   | - 0.02              |
| 1979 | 244                      | 239.62    | + 4.38   | + 1.79              |
| 1980 | 251                      | 240.82    | +10.18   | + 4.06              |
| 1981 | 258                      | 242.63    | +15.37   | + 5.96              |

Source: Table III-1 and Equation V-2.

\*See explanation in Chapter III.

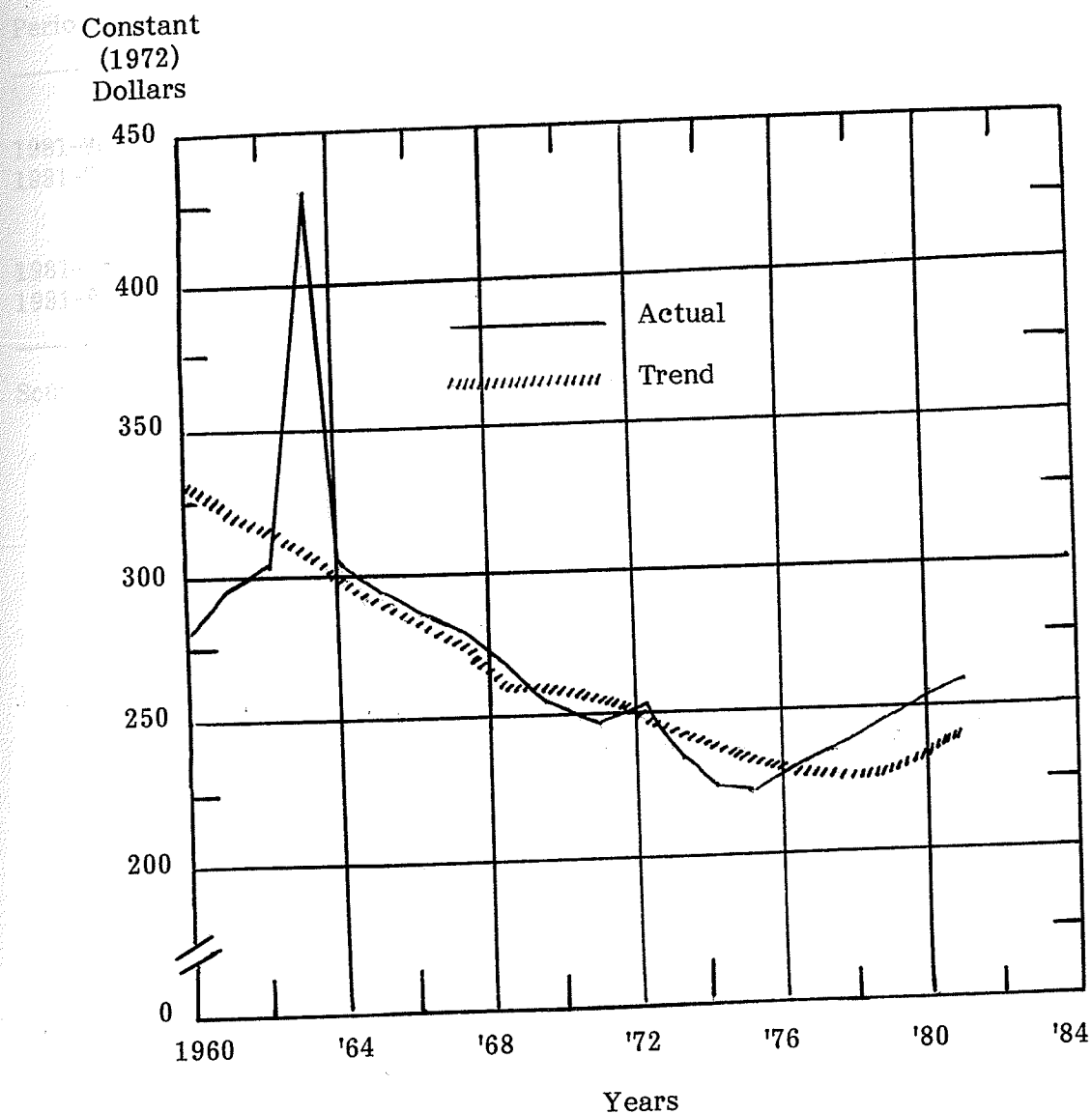
FIGURE V-1  
ACTUAL AND TREND VALUES OF REAL  
DISPOSABLE INCOME PER CAPITA  
IN NORTH AMERICA  
1960-1981



Source: Table V-1.

FIGURE V-2

ACTUAL AND TREND VALUES OF AIR  
FARE TO JAMAICA, WEST INDIES  
FROM NORTH AMERICA  
1960-1981.



Source: Table V-2.



TABLE V-3

PROJECTED RATES OF GROWTH OF REAL DISPOSABLE  
INCOME PER CAPITA AND REAL AIR FARE, NORTH  
AMERICAN TRAFFIC TO JAMAICA, 1981-1991.

| Period  | Variable       | <u>Annual Percentage Growth Rate</u> |                       |      |
|---------|----------------|--------------------------------------|-----------------------|------|
|         |                | Estimated                            | 95% Confidence Limits |      |
| 1981-86 | Income<br>Fare | 2.02                                 | 1.34;                 | 2.69 |
| 1981-86 |                | 1.48                                 | -0.80;                | 3.76 |
| 1981-91 | Income<br>Fare | 1.93                                 | 1.60;                 | 2.25 |
| 1981-91 |                | 1.99                                 | 0.85;                 | 3.13 |

Source: Calculations made by the writer.



Similarly, for the period 1981 to 1991, the rate of growth of traffic would be:

$$d \log T = 2.2266 (1.93) - 1.4723 (1.99) = 1.37\% \quad (V-7)$$

In addition to these estimates, other probable growth rates of traffic can be derived by assuming various combinations of rates of growth of income and air fare included in the 95 percent confidence intervals for these two independent variables. For illustrative purposes, different combinations of the limits of the rates of growth of income and air fare were derived and are designated as cases A through D in Table V-4.

It should be noted that the largest impact (negative or positive) on the growth rate of traffic would result from combining the lower limit of income with the upper limit of air fare growth rates and vice versa. This is so because the growth rates of income and traffic are directly related while the relationship between air fare and traffic is inverse. Thus the lowest growth rate of income combined with the highest growth rate of air fare would generate the lowest growth rate of traffic (Case A in Table V-4). Similarly, the highest rate for income combined with the lowest rate for air fare would result in the highest rate of growth of traffic (Case B).

By contrast, less of an impact on traffic growth would result from the combination of the two lower limits (Case C) or the two upper limits (Case D) of the rates of growth of income and air fare; for in these instances the influence of these two variables on traffic growth will tend to be offsetting. The combinations can be interpreted in terms of what is likely to happen to traffic growth when the effect of low relative increases (or decline) in real income is offset by low (declining) air fare. Alternatively, they would indicate what the impact on traffic growth would be if air fare increases at the high rate while the high growth of income is at the same time serving as an offsetting influence.

As the cases in Table V-4 show, these combinations yield a range of growth rates of traffic whose interpretation will become more relevant as the growth of

income and air fare move in the direction of the limits indicated. For instance, the trend investigation in this study reveals that both income and fare are rising. It would therefore be relevant to ask what would be the rate of growth of traffic if these two independent variables were to increase at their maximum projected rates. The answer to this question is provided by Case D in the table. Similarly, if at some later date the trend in both income and fare were simultaneously reversed the relevant question could be answered by Case C. Should income growth move towards its projected upper limit while air fare simultaneously approaches its projected lower limit, the relevant question regarding traffic growth would be answered by Case B, and so forth.

Examination of the data reveals that up to 1974 the "historical" (1960-1974) annual growth rate of all air traffic to Jamaica was 12.5 percent. Since 1974 the growth of traffic has fallen to make the historical (1960-1981) rate about 7.9 percent annually (Table VI-1). This will be called the "modified historical rate." As the projections from this analysis indicate, and for other reasons which are offered below, neither the historical nor the modified historical rate is likely to occur over the period covered by the forecast. Therefore the application of such rates to the years ahead (for example by policy-makers and planners) could be misleading since they appear inconsistent with important recent developments (discussed below) in the air transport industry.

It will be observed (see Table V-5) that at the historical rate the traffic volume would be about 60.7 percent higher in 1986 and 283.4 percent higher in 1991 than at the projected rates; and even at the modified historical rate the traffic volume would be 30.4 percent higher in 1986, and 86.7 percent higher in 1991 than at the projected rates. Therefore, such disparities in anticipated traffic volume suggest that Jamaica could experience large "excess capacity" in her tourist facilities in the future if planning were done at the historical rate or even at the

TABLE V-4

PROJECTED RATES OF GROWTH OF AIR TRAFFIC FROM  
NORTH AMERICA TO JAMAICA BASED ON PROJECTED  
GROWTH RATES OF REAL DISPOSABLE INCOME AND  
REAL AIR FARE, 1981-1991.

| Period  | Case | Annual Percentage Growth |       |         |
|---------|------|--------------------------|-------|---------|
|         |      | Income                   | Fare  | Traffic |
| 1981-86 | A    | 1.34                     | 3.76  | -2.55   |
| 1981-86 | B    | 2.69                     | -0.80 | 7.17    |
| 1981-86 | C    | 1.34                     | -0.80 | 4.16    |
| 1981-86 | D    | 2.69                     | 3.76  | 0.45    |
| 1981-91 | A    | 1.60                     | 3.13  | -1.05   |
| 1981-91 | B    | 2.25                     | 0.85  | 3.76    |
| 1981-91 | C    | 1.60                     | 0.85  | 2.31    |
| 1981-91 | D    | 2.25                     | 3.13  | 0.40    |

Source: Calculations made by the writer.

Note: The percentage under Income and Fare are the 95 percent confidence limits of their projected rates of growth; see Table V-3 and text.

TABLE V-5

PREDICTED VOLUME OF AIR TRAFFIC FROM NORTH AMERICA  
TO JAMAICA IN 1986 AND 1991, AT SELECTED ANNUAL  
GROWTH RATES.

| Description                      | <u>Growth Rate</u><br>Magnitude<br>(Percent) | <u>Air Traffic</u> |         |
|----------------------------------|----------------------------------------------|--------------------|---------|
|                                  |                                              | 1986               | 1991    |
|                                  |                                              | (Number)           |         |
| Historical <sup>a</sup>          | 12.5                                         | 569197             | 1025712 |
| Modified Historical <sup>a</sup> | 7.90                                         | 461963             | 675639  |
| Projected <sup>b</sup>           | 2.32                                         | 354244             |         |
| Projected <sup>c</sup>           | 1.37                                         |                    | 361905  |

Source: Calculations made by the writer based on data in Tables III-1, and VI-1, and earlier analysis in this chapter.

Notes: <sup>a</sup>See text for explanation.

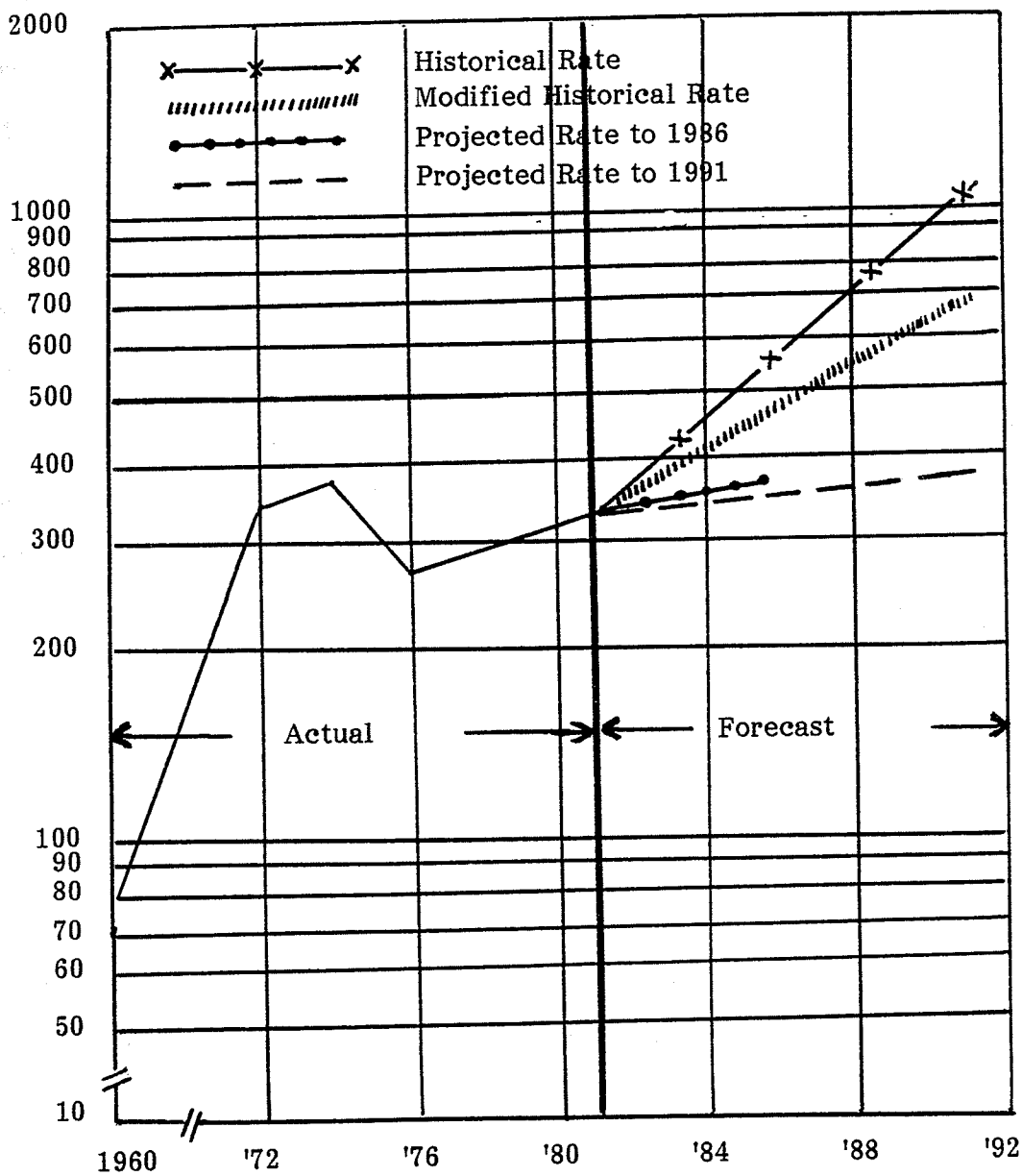
<sup>b</sup>This is the projected rate to 1986; see text.

<sup>c</sup>This is the projected rate to 1991; see text.

FIGURE V-3

PREDICTED VOLUME OF AIR TRAFFIC FROM NORTH  
AMERICA TO JAMAICA AT SELECTED ANNUAL  
GROWTH RATES.

Passengers  
(Thousands)



Source: Table V-5.

Years

Note that this figure is on a semilogarithmic scale.



modified historical rate instead of at the more conservative rates projected by this study. This is an important policy issue which will receive more attention later in this study. Attention will now be turned to some possible reasons for the projected slower growth rates indicated above.

### Some Recent Developments

One important recent development in the air transport industry is the changing pattern of unit operating cost which was shown earlier to have important implications for air fares and consequently traffic growth. As the evidence indicates (see Table II-11 and Figure II-2) unit costs exhibited a downward trend up to 1969, then started to rise in 1970 and have since continued on an upward trend. It is this upward trend in cost that will help to dampen the growth of traffic. The main contributors to this recently rising cost pattern were discussed in Chapter II.

With respect to future technological advance, the air transport industry faces certain constraints which also have unfavorable cost implications. Technological evolution in the industry has so far produced larger and faster aircraft whose cost characteristics have the potential for fare reductions, and consequently the generation of larger volumes of air traffic and tourism. While technological advance may be expected to continue into the future, it is not likely to do so at the same pace as it did during the last two decades and especially during the 1960's (see Chapter II). Presumably, the rate of advance of technological innovation will continue to subside as the economies of all the feasible configurations of aircraft sizes and speeds are fully exploited. That is, the economies of scale associated with larger and faster aircraft will reach their limit at some point beyond which it will not be economical to build aircraft of larger sizes and faster speeds.

With respect to size, aircraft larger than the present jumbo jets could face problems of lower load factors, and greater excess capacity than now prevail. This

would preclude the achievement of maximum economies associated with their large size. Another possible constraint on the size of aircraft is the dependence of aircraft manufacturers and airlines on the cooperation of governments in providing the necessary ground facilities including airports and the supporting infrastructure to receive and dispatch larger aircraft and volumes of traffic. Unless the availability of such complementary ground facilities is assured, development and use of these aircraft would be seriously hampered even when their potential for reducing unit cost has been established.

Within the context of greater speeds, the supersonic transport (SST) must be brought into focus. Despite its potential to achieve unit cost of operation comparable to those of the jumbo and other subsonic jets, and its great time-saving ability, there are some uncertainties which might forestall further development and market adoption of this and similar types of aircraft. One such uncertainty is public reaction to the sonic boom. Strong negative reaction to this could restrict the use of such aircraft to certain routes (such as trans-oceanic) where the effect of the boom on population would be minimized. Such restricted use will limit the profitability of producing the aircraft, and might not make its production economically worthwhile. Further technological developments could perhaps result in a reduction of the sonic boom, but the cost of this must be weighted against the potential returns that such developments will generate.

Another possible problem is that despite the availability of capital for jet financing observed earlier, such capital could become relatively scarce and expensive with increasing uncertainties about public acceptance and marketability of newer aircraft technology. Presumably, private sponsorship of this technology is motivated by its potential profitability. Where such technology is government sponsored, the motivation might be more "political" (example national prestige), but even then the economic feasibility of such projects cannot (or should not) be ignored. The large<sup>1</sup> capital requirements and the resulting scarcity and increased



cost of such capital could conceivably forestall future technological advance in the industry, and consequently arrest the growth of international air tourism.

The structure of the airline industry also has some implications for operating cost and air fares. In examining this structure it was observed (Chapter IV) that the bilateral process and the related potential for restrictive entry could result in some inefficient airlines operating in the market. Inefficiency manifested in relatively low productivity and high operating cost could motivate these airlines to oppose fare reductions or seek higher fares through the industry's rate-making machinery as they attempt to offset their relatively high costs. To the extent that such fare negotiations contribute to downward rigidity in the level of air fares, the result would be a stunted growth of air traffic.

Other factors with the potential for a negative impact on traffic growth can be identified. Among these are continued high rates of inflation which reduce the growth of real disposable incomes in the United States and Canada (the two major suppliers of tourists to Jamaica). Based on the evidence given earlier with respect to the income elasticity of demand for air transport, a reduction in the growth of real disposable income would have a dampening effect on tourist growth to Jamaica.

Within the context of inflation one must also consider price level changes in the host country, and the cross-elasticity of demand with respect to goods and services that are complementary to air transportation in the "consumption" of a vacation. Thus even if inflationary pressure eases in the home country such that the growth of real disposable income increases, the demand for air transportation may not increase, for this will also be influenced by the price of accommodation, food and other goods and services in the host country. For instance, exorbitant prices in the tourist-host countries may dampen the responsiveness of potential travelers to increases in their incomes or to reduction in air fares, in terms of their demand for air transportation in particular markets.

Some indication of price level changes in Jamaica relative to those in the United States can be obtained from Table V-6. As those data indicate, the average annual increase in the prices of consumer goods has been more than twice as fast in Jamaica as in the United States. Since these goods typically account for a large<sup>2</sup> part of a vacation budget, continued rapid increase in their prices is likely to have a negative impact on the future growth of air tourist traffic to Jamaica.

With higher air fares and higher prices in Jamaica, other vacation spots that are natural (climatic, scenery, etc.) competitors of Jamaica could conceivably become more attractive to tourists thereby reducing the growth of traffic to Jamaica. Tourists for instance might seek some of the less popular Caribbean destinations where the tourist industry is not as well developed (or "commercialized") as in Jamaica and where more modest tourist facilities (accommodation, services, etc.) and relatively few users of these facilities make the destination cost of a vacation there low in comparison to one in Jamaica. There is also the possibility that with higher air fares Jamaica could lose some of its potential visitors to other vacation places with comparable climate that are accessible by relatively low-cost road transportation. For example, the North American tourist whose preference is for a Jamaican vacation might in the presence of high air fares settle for a substitute vacation in Florida, Mexico, or some other Central American country that can be reached by his automobile.

It is also appropriate to recall the discussion in Chapter IV regarding the effects of "distance taper" on the competitive position of Jamaica. There, some evidence was provided to suggest that the distance taper with respect to airline fare structures has resulted in inter-destination competition which has caused Jamaica's share of traffic to the Caribbean to be declining in recent years. For details see Tables IV-6 and IV-7.

It is conceivable that there will also be some developments that have some positive influence on traffic growth. For instance, the availability of increased

TABLE V-6

CHANGES IN THE UNITED STATES AND JAMAICAN  
PRICE LEVELS, 1967-1981.

| Year | United<br>States<br>Consumer<br>Price<br>Index | Percent<br>Change<br>Over<br>Previous<br>Year | Jamaican<br>Consumer<br>Price<br>Index | Percent<br>Change<br>Over<br>Previous<br>Year |
|------|------------------------------------------------|-----------------------------------------------|----------------------------------------|-----------------------------------------------|
| 1967 | 100.0                                          |                                               | 100.0                                  |                                               |
| 1968 | 104.2                                          | 4.2                                           | 109.4                                  | 9.4                                           |
| 1969 | 109.8                                          | 5.4                                           | 116.2                                  | 6.2                                           |
| 1970 | 116.3                                          | 5.9                                           | 127.5                                  | 9.7                                           |
| 1971 | 121.3                                          | 4.3                                           | 136.0                                  | 6.7                                           |
| 1972 | 125.3                                          | 3.3                                           | 144.0                                  | 5.9                                           |
| 1973 | 133.1                                          | 6.2                                           | 171.6                                  | 19.2                                          |
| 1974 | 147.7                                          | 11.0                                          | 222.7                                  | 29.7                                          |
| 1975 | 161.2                                          | 9.1                                           | 264.8                                  | 18.9                                          |
| 1976 | 170.5                                          | 5.8                                           | 295.5                                  | 11.2                                          |
| 1977 | 181.5                                          | 6.5                                           | 329.2                                  | 11.4                                          |
| 1978 | 195.4                                          | 7.7                                           | 450.2                                  | 36.7                                          |
| 1979 | 217.4                                          | 11.3                                          | 520.0                                  | 15.5                                          |
| 1980 | 246.9                                          | 13.6                                          | 612.6                                  | 17.8                                          |
| 1981 | 272.4                                          | 10.3                                          | 689.2                                  | 12.5                                          |

Source: United States Department of Commerce, Survey of Current Business (Various Issues); National Planning Agency, Economic and Social Survey of Jamaica (Various Issues).

leisure time is one such possible influence. That is, people are likely to travel more often and longer distances if they have more leisure time. But this presupposes that increased leisure is not achieved at the expense of a reduction in consumers' money and real incomes, for this would tend to negate the effect of increased leisure time on tourist travel.

Some positive impact on growth is also likely to result from airlines' effort to increase load factors through such means as advance purchase and other fare concessions. Although charter and similar flight arrangements have so far not been a major contributor to the number of tourist arrivals in Jamaica (see Chapter IV), it is conceivable that with the rising cost of travel on scheduled flights, such special arrangements could become a more important force in generating traffic to Jamaica. For example, innovative travel promoters might seek to penetrate that travel market with the use of "package tours" which may substantially reduce the total cost of a vacation to Jamaica.

This could then put such a vacation within the reach of a larger number of tourists many of whom would probably not have travelled even if the rise in scheduled air fares were to cease or be reversed. Scheduled airlines may also seek to modify routes and schedules so as to perform more nonstop service which will not only appeal to traffic but will help to reduce their operating cost. While these factors may help to enhance traffic growth, they are not likely to be of sufficient impact to completely offset that of rising cost and the other negative traffic growth factors discussed earlier. Therefore, the net result is likely to be a decline in the growth rate of air traffic as forecasted earlier in this chapter.

## CHAPTER V

## NOTES

1. The industry spent more than \$20 billion on new flight equipment during the decade of the 1960's, and was estimated to spend nearly \$70 billion in the 1970's. About 50 percent more investment was needed to get a dollar of revenue in 1970 than was the case in 1960. See International Air Transport Association (The Airlines' Cost/Revenue Struggle), op. cit., p. 15.
2. See estimates in Chapter III for a 10-day vacation to an American tourist.

## PART II

### THE ECONOMIC IMPACT OF INTERNATIONAL TOURISM



The air transport developments and the resulting trends of international tourism growth investigated in Part I have important economic implications for the tourist host country. Presumably, that country's concern with the growth of air tourism is based on the potential contribution of tourism to that nation's economy. It is therefore appropriate to investigate the framework within which this economic potential of tourism can be determined.

Before undertaking that task (Chapter VII), an investigation will be made of the change in the nature and magnitude of economic activity that the growth of air traffic has brought about in the tourist industry of Jamaica. This is done in Chapter VI. In Chapter VII the economic development potential of tourism is first examined, then measurement of its economic impact is investigated. In doing so, a methodology which has been employed by several studies is briefly reviewed and assessed. An alternative framework is then presented and applied.



## CHAPTER VI

### THE IMPACT OF AIR TRANSPORT ON THE CHARACTER OF JAMAICAN TOURISM

In the preceding discussion the role of air transportation in the growth of international tourism was investigated. Accompanying this growth have been some important changes in the size and economic nature of the tourist industry in host countries like Jamaica. For instance, the growth of "air tourism" has dictated increased public and private investment in airports, infrastructure, hotels, and other tourist-related facilities.

This chapter will investigate how the growth of "air tourism" has transformed the economic nature of the Jamaican tourist industry. This change will be examined with respect to the demand and supply of tourist facilities. For purposes of this analysis the term "tourist facilities" will be used as a collective label to represent the various kinds of facilities at the point of destination. Included are such facilities as accommodation, dining, recreation and transportation. Accommodation is no doubt the most important of these and will therefore be the focus of the analysis. Before undertaking the analysis, it is appropriate to briefly put things in historical perspective.

#### Brief History of Jamaican Tourism

Tourism as it exists in Jamaica today, owes much of its nature and magnitude to the air transport industry. The insular character of the country precludes international travel by any mode except air or sea, and in recent years the bulk of tourists to the island use air transportation (See Table VI-1). As indicated above, this air traffic growth has changed the economic character of tourism such that

this industry now assumes a much more active economic role in that country than it did earlier in its history.

Prior to the Second World War, the cruise ship accounted for almost the entire volume of tourist traffic to Jamaica. Primarily of United States origin (there were also a few British and French vessels that toured the area), these ships would stay in port for a day or two while their passengers visited the cities and shopped before returning on board for accommodation.<sup>1</sup> Despite its introductory role in acquainting tourists with the area, the cruise ship trade generated relatively little economic activity on the island. However, it can be said that it did set the stage for a subsequently expanding tourist industry of much greater economic significance.

Since World War II, and especially since the jet revolution of the late 1950's, it has been the air rather than sea traffic that has predominated (Table VI-1),<sup>2</sup> and this change in traffic has given a new dimension to the country's tourist industry. It should be noted here again that although the jet revolution has lost momentum in recent years (Chapters II and V), it has implanted its impact on the nature of Jamaican tourism, having transformed it from predominantly short-stay to long-stay visitors with the related change in economic impact. The relatively long stay (see evidence below) of the air transported tourist compared to that of his cruise ship counterpart dictates the need for expanded tourist facilities and services on the island. The economic significance of such expansion will be investigated later.

#### Elements of Demand for Tourist Facilities

Three indicators of demand reflect the magnitude of the demand<sup>3</sup> for Jamaican tourist facilities in a tourist industry dominated by air transportation. These are the number and growth of tourist arrivals, the length of time these tourists stay, and their associated expenditures. These will be discussed in turn.

TABLE VI-1

MODE OF TRAVEL OF TOURISTS ARRIVING  
IN JAMAICA, 1956-1981.

| Year | <u>Arrivals by Air</u> |         | <u>Arrivals by Sea</u> |         |
|------|------------------------|---------|------------------------|---------|
|      | Number                 | Percent | Number                 | Percent |
| 1956 | 51,876                 | 97.2    | 1,489                  | 2.8     |
| 1957 | 59,739                 | 97.4    | 1,567                  | 2.6     |
| 1958 | 64,704                 | 98.5    | 985                    | 1.5     |
| 1959 | 71,530                 | 98.9    | 796                    | 1.1     |
| 1960 | 81,857                 | 99.3    | 563                    | 0.7     |
| 1961 | 75,517                 | 99.4    | 456                    | 0.6     |
| 1962 | 77,577                 | 98.8    | 942                    | 1.2     |
| 1963 | 80,394                 | 99.3    | 567                    | 0.7     |
| 1964 | 96,869                 | 99.6    | 389                    | 0.4     |
| 1965 | 159,619                | 99.6    | 641                    | 0.4     |
| 1966 | 208,870                | 99.7    | 625                    | 0.3     |
| 1967 | 212,278                | 99.5    | 1,067                  | 0.5     |
| 1968 | 256,661                | 99.4    | 1,549                  | 0.6     |
| 1969 | 276,929                | 99.7    | 833                    | 0.3     |
| 1970 | 293,757                | 99.5    | 1,476                  | 0.5     |
| 1971 | 338,625                | 99.6    | 1,360                  | 0.4     |
| 1972 | 363,522                | 99.5    | 1,826                  | 0.5     |
| 1973 | 371,182                | 99.4    | 2,241                  | 0.6     |
| 1974 | 429,523                | 99.2    | 3,464                  | 0.8     |
| 1975 | 393,830                | 99.5    | 1,979                  | 0.5     |
| 1976 | 324,757                | 99.1    | 2,949                  | 0.9     |
| 1977 | 308,409                | 99.3    | 2,174                  | 0.7     |
| 1978 | 339,592                | 98.9    | 3,777                  | 1.1     |
| 1979 | 370,782                | 99.1    | 3,367                  | 0.9     |
| 1980 | 356,120                | 99.1    | 3,234                  | 0.9     |
| 1981 | 406,355                | 98.8    | 4,815                  | 1.2     |

Source: Annual Report of the Jamaican Tourist Board (Various Issues); Travel Statistics-Jamaica, 1970, Jamaica Tourist Board, Kingston, Jamaica, 1971; and Economic and Social Survey of Jamaica, National Planning Agency, Kingston, Jamaica, (Various Issues).

Table VI-2 shows the total number of tourists arriving in Jamaica since the late 1950's, the period during which the use of jet aircraft became popular. The growth of these arrivals parallel quite closely the growth of air traffic to the island, for as shown previously, nearly all of those tourists travelled by air, (see Table VI-1). This growth of tourist arrivals which is facilitated by air transportation has implications for the demand for tourist facilities in Jamaica. Since these air transported tourists are primarily long-stay tourists (to be explained below), the demand for these facilities will increase as tourist arrivals increase. Thus the data in Table VI-2 are indicative of the increase in demand<sup>4</sup> for tourist facilities. However, in measuring and interpreting this demand, those numbers alone are not sufficiently illuminating. Therefore some other demand indicators must be investigated.

One important change in the character of Jamaican tourism which air transportation has induced is the length of time a tourist stays on the island. Unlike the "short stay" (less than 3 days) cruise ship tourist, the typical air transported tourist is a "long stay" (three or more days) visitor. Thus with the growth of air traffic to Jamaica, the proportion of long stay tourists has been increasing while that of short stay tourists has been declining correspondingly (Table VI-3).

The available data indicate that over the last six years the average length of stay of tourists to Jamaica was about 6-8 days.<sup>5</sup> This is far in excess of the one or two days stay characteristic of cruise ship visitors. From the average length of stay of tourists in the country can be computed the number of "tourist days," a measure which supersedes "the total number of tourists" to the country as far as the demand for tourist facilities and general economic impact of tourism are concerned. The concept of "tourist days" takes into account both the number of tourists and the length of stay. For instance, one tourist staying ten days would give ten tourist days. On the other hand, it would take five short stay tourists

TABLE VI-2  
TOURIST ARRIVALS IN JAMAICA, 1958-1981

| Year | Number of Arrivals |
|------|--------------------|
| 1958 | 65,689             |
| 1959 | 72,326             |
| 1960 | 80,420             |
| 1961 | 75,973             |
| 1962 | 78,519             |
| 1963 | 80,961             |
| 1964 | 97,258             |
| 1965 | 160,260            |
| 1966 | 209,495            |
| 1967 | 213,345            |
| 1968 | 258,210            |
| 1969 | 277,762            |
| 1970 | 295,233            |
| 1971 | 339,985            |
| 1972 | 365,348            |
| 1973 | 373,423            |
| 1974 | 432,987            |
| 1975 | 395,809            |
| 1976 | 327,706            |
| 1977 | 310,583            |
| 1978 | 343,370            |
| 1979 | 374,149            |
| 1980 | 359,354            |
| 1981 | 411,170            |

Source: National Planning Agency, Economic and Social Survey of Jamaica, (Various Issues).



spending two days each to produce the same ten tourist days. Thus the increased proportions of long stay tourists indicated earlier suggest that the demand for tourist facilities has been increasing much faster than the number of tourists suggests.

Since the long stay tourist will require more days (nights) of accommodation, days of service, recreation, inland travel and so forth, he generates more economic activity than his short-stay counterpart. Such demand for instance will induce investment in hotels, recreational facilities and infrastructure. Some evidence on this investment can be more appropriately discussed under the supply of tourist facilities.

Closely related to length of stay is tourist expenditure—a third indicator of the demand for tourist facilities. That is, ceteris paribus, the longer the stay, the greater will be these expenditures on accommodation, food, recreation and entertainment, local travel and so forth. It follows, therefore, that the relatively long stay of the tourist who travels to Jamaica by air will generate much larger tourist expenditures than the short stay of the cruise ship tourist.

The larger expenditure of the air travelled tourist is not only related to his longer stay, but also the nature of his demand, so that even on a daily basis his expenditures are still likely to be much greater than those of the cruise ship tourist. For instance, it has been estimated<sup>6</sup> that accommodation and food account for about 70 percent of tourist expenditures in the Caribbean. If the cruise ship passenger has these needs met on board his vessel (as is likely to be the case), then even if his other expenditures (on land) are identical to the non-accommodation, nonfood expenditures of the "air tourist," this would mean that he spends only about \$30 for every \$100 spent in the host country by the air transported tourist. Thus the economic impact of the expenditure by the cruise ship tourist would also be correspondingly low.

TABLE VI-3

PERCENTAGE DISTRIBUTION OF LONG STAY AND SHORT  
STAY TOURIST ARRIVING IN JAMAICA, 1945-1980.

| Year | Long Stay<br>(Percentages) | Short Stay |
|------|----------------------------|------------|
| 1945 | 12                         | 88         |
| 1946 | 19                         | 81         |
| 1947 | 25                         | 75         |
| 1948 | 21                         | 79         |
| 1949 | 20                         | 80         |
| 1950 | 24                         | 76         |
| 1951 | 26                         | 74         |
| 1952 | 23                         | 77         |
| 1953 | 23                         | 77         |
| 1954 | 32                         | 68         |
| 1955 | 37                         | 63         |
| 1956 | 31                         | 69         |
| 1957 | 36                         | 64         |
| 1958 | 39                         | 61         |
| 1959 | 38                         | 62         |
| 1960 | 35                         | 65         |
| 1961 | 34                         | 66         |
| 1962 | 38                         | 62         |
| 1963 | 40                         | 60         |
| 1964 | 42                         | 58         |
| 1965 | 59                         | 41         |
| 1966 | 62                         | 38         |
| 1967 | 65                         | 35         |
| 1968 | 61                         | 39         |
| 1969 | 63                         | 37         |
| 1970 | 65                         | 35         |
| 1971 | 74                         | 26         |
| 1972 | 76                         | 24         |
| 1973 | 74                         | 26         |
| 1974 | 77                         | 23         |
| 1975 | 68                         | 32         |
| 1976 | 67                         | 32         |
| 1977 | 66                         | 34         |
| 1978 | 69                         | 31         |
| 1979 | 67                         | 33         |
| 1980 | 68                         | 32         |

Source: National Planning Agency, Economic and Social Survey of Jamaica (Various Issues); Travel Statistics - Jamaica, 1970; and John Freeman Jones, Jr., Tourism as a Tool for Economic Development, Ph.D. dissertation, University of Florida, 1970, p. 220.



Table VI-4 shows the amount tourists spent in Jamaica during the period 1960-1980. As the data indicates, tourist expenditures increased at an average annual rate of about 8.0 percent over this period. When deflated, these expenditures also showed similar rates of change. For instance, when the figures were converted into constant 1967 dollars, the rate of increase in tourist expenditures was 6.2 percent instead of the 8.0 percent increase in current dollars. It should be noted that these expenditures have exhibited a pattern of growth<sup>7</sup> similar to that of air traffic to Jamaica over roughly the same period of time.

As the above discussion indicates, air transport has produced a type of Jamaican tourism that is characterized by a relatively rapid growth rate, longer visitor stay, and greater expenditures than the cruise ship trade which was the predominant type of tourism in the Caribbean area prior to the advent of jet technology in air transportation. As seen, the large numbers of tourists combined with their relatively long stay generate large tourist expenditures which reflect the growth of demand for tourist facilities in the area.

Given the observation that a longer stay has characterized the "air tourist" relative to the "sea tourist," one might be tempted to identify the length of stay at the point of destination as a determinant of the demand for tourist facilities there. However, it can be argued that the length of stay will largely depend on the prices of those facilities, and thus price becomes the more relevant determinant of demand. Other determinants include the incomes of the tourists and the prices of related goods or services—notably the price (cost) of air transportation to Jamaica.

One might expect that the lower their prices, the more tourist facilities will be demanded, *ceteris paribus*. For instance, lower hotel rates might induce some visitors to demand more accommodation (hotel nights) on a given vacation,<sup>8</sup> and thus increase the total amount of these facilities that they demand over a given time period. Conversely, a rise in prices would tend to decrease the amount of these facilities demanded per unit of time. The more price-conscious tourist who is likely to be a relatively low income earner may be expected to be more sensitive to

TABLE VI-4  
TOURIST EXPENDITURES IN JAMAICA  
1960-1980

| Year | Tourist Expenditures<br>(U. S. \$ millions) |
|------|---------------------------------------------|
| 1960 | 40.3                                        |
| 1961 | 40.9                                        |
| 1962 | 36.7                                        |
| 1963 | 37.8                                        |
| 1964 | 43.7                                        |
| 1965 | 65.0                                        |
| 1966 | 78.4                                        |
| 1967 | 79.8                                        |
| 1968 | 87.8                                        |
| 1969 | 93.5                                        |
| 1970 | 98.6                                        |
| 1971 | 116.3                                       |
| 1972 | 138.2                                       |
| 1973 | 148.3                                       |
| 1974 | 155.3                                       |
| 1975 | 149.7                                       |
| 1976 | 123.2                                       |
| 1977 | 104.5                                       |
| 1978 | 148.2                                       |
| 1979 | 194.3                                       |
| 1980 | 186.5                                       |

Source: National Planning Agency, Economic and Social Survey of Jamaica  
(Various Issues).

likely to be a relatively low income earner may be expected to be more sensitive to such price changes than tourists in higher income groups. Therefore, as the proportion of relatively low income tourists increases, one might also expect the price elasticity of demand for tourist facilities to get higher.<sup>9</sup>

It is fairly well established<sup>10</sup> that the demand for foreign travel is income elastic. This suggests that the demand for tourist facilities is also income elastic since such travel will usually necessitate the use of these facilities which constitute a major part of a vacation cost. Thus as more and more individuals in the major tourist generating countries find that their real personal or family incomes increase, the demand for tourist facilities in foreign countries by these income earners will also increase so that at any price more will be demanded.

The rising of income and the demand elasticity that accompanies it, also have implications for the change in the economic status of the tourists received in Jamaica. That is, with the increasing volume of tourism in the island there is also a larger percentage of relatively low income tourists. This reinforces the nature of the price elasticity of demand discussed above where it was suggested that this category of tourists is likely to be more responsive to the pricing of tourist facilities than its more opulently endowed counterpart, (see footnote 9). Given this sensitivity to prices, the total revenue from the sale (or hire) of these facilities will increase by charging lower rates thereby luring a greater volume of tourists from the lower income brackets.

The prices of related goods or services will also affect the demand for tourist facilities. Foremost among these is the price (cost) of transportation to and from the place of vacation. Transportation and destination facilities (especially accommodation) can be considered complements in the "consumption" of a vacation. Both are necessary to make the vacation possible. Thus the price of one will affect the demand for the other. For instance, a reduction in air fares between the United

States and Jamaica will ceteris paribus increase the amount of tourist accommodation demanded in Jamaica. Crude estimates<sup>11</sup> made by this study produced negative cross elasticity coefficients which reflect the complementary relationship between air transportation and accommodation indicated above.

Cross elasticity analysis is also relevant in examining the demand for substitute tourist facilities. For instance, if the New York-Puerto Rico air fare, the New York-Jamaica air fare, tastes, preferences and other things remain constant while hotel rates in Puerto Rico ( $r$ ) increase by a certain percentage, one can determine the relative change in the number of bed/nights demanded in Jamaica ( $j$ ) during the relevant time period. On the above assumptions, these facilities are substitutes if a rise in ( $r$ ) leads to a greater quantity of ( $j$ ) demanded. Jamaica can then apply such information in subsequent pricing policy to promote or discourage the demand for its tourist facilities depending on the goal sought.

#### The Supply of Tourist Facilities

The change in nature of Caribbean tourism has dictated certain changes in the supply of tourist facilities, and this has implications for the factor combinations and costs involved in the production of these facilities. In the days of the cruise ship trade when little or no accommodation was demanded by the short stay visitors, little investment in tourist facilities was required. At that time tourist facilities on the islands consisted mainly of small retail outlets which were engaged in the sale of craft and other souvenir-type items. The capital requirements and related fixed costs of supplying these items were relatively low.

With the growth of air traffic to the area and the relatively long stay associated with this kind of tourist (see discussion above), the supply of tourist facilities has changed to include an emphasis on accommodation. Table VI-5 shows the growth of tourist accommodation in Jamaica over the relevant period. As these

data indicate, available accommodation increased at an average (geometric) annual rate of about 5.2 percent which was somewhat slower than both the "historical" and the "modified historical" rates of increase in air traffic to Jamaica over the same period, (see Chapter V).

It is this growth of air traffic (and hence long stay tourists) relative to the amount of available accommodation that stimulated the increases in accommodation indicated above. For instance, in 1969 the Jamaican Tourist Board estimated that the number of potential tourists turned away for lack of space equalled the number who visited Jamaica at that time.<sup>12</sup> By 1976 available accommodation had more than doubled, but it has since then been declining such that by 1980 it was only 54.9 percent higher than in 1969 (see Table VI-5 and footnote number 19).

The growth of accommodation indicated above represents increased investment in these facilities which require relatively large amounts of capital and can be indentified with large fixed costs compared to the facilities that characterized the era of cruise ship dominance. This suggests a change in the ratio of inputs (particularly capital and labor) used, and in the fixed-variable composition of the costs of supplying these facilities.

It is not surprising that studies have shown that service industries (which include tourism) exhibit a higher labor-capital ratio in production (1.39) than all other activities (1.034), indicating that service activities are more labor intensive than other activities.<sup>13</sup> This difference in labor intensity is likely to be amplified in the less developed countries where labor is abundant and capital relatively scarce. However, as the tourist industry in these countries develops and caters to visitors from the more advanced, relatively capital-abundant countries, a larger proportion of capital may characterize the factor mix in the production of tourist facilities by the less developed host countries. Such an input mix may, in the face of general capital scarcity in these countries cause their tourist industry

TABLE VI-5  
TOURIST ACCOMMODATION AVAILABLE IN JAMAICA  
1960-1980

| Year | Number of Beds | <u>Increase Over Previous Year</u> |         |
|------|----------------|------------------------------------|---------|
|      |                | Number                             | Percent |
| 1960 | 6,140          | -                                  | -       |
| 1961 | 6,758          | 618                                | 10.06   |
| 1962 | 7,471          | 713                                | 10.55   |
| 1963 | 7,563          | 92                                 | 1.23    |
| 1964 | 7,657          | 94                                 | 1.24    |
| 1965 | 7,941          | 284                                | 3.70    |
| 1966 | 8,250          | 309                                | 3.89    |
| 1967 | 8,911          | 661                                | 8.01    |
| 1968 | 9,616          | 705                                | 7.91    |
| 1969 | 10,950         | 1334                               | 13.87   |
| 1970 | 13,675         | 2725                               | 24.88   |
| 1971 | 15,690         | 2015                               | 14.73   |
| 1972 | 17,944         | 2254                               | 14.36   |
| 1973 | 19,897         | 1953                               | 10.88   |
| 1974 | 21,951         | 2054                               | 10.32   |
| 1975 | 22,250         | 299                                | 1.36    |
| 1976 | 23,942         | 1692                               | 1.36    |
| 1977 | 20,774         | -3168                              | -13.23  |
| 1978 | 17,880         | -2894                              | -13.93  |
| 1979 | 17,186         | - 694                              | - 3.88  |
| 1980 | 16,966         | - 220                              | - 1.23  |

Source: National Planning Agency, Economic and Social Survey of Jamaica (Various Issues).



(despite its service character), to become more capital-intensive than the average for all industries.<sup>14</sup> This has implications for capital availability and the opportunity cost of such capital, (see discussion below and in the next chapter).

The capital "burden" which such tourist facilities impose on the capital-deficient developing countries is mitigated by the investment of expatriate firms in these facilities (Chapter VII). Airlines for instance became involved in supplying accommodation in the Caribbean during the 1960's by constructing a number of hotels through their hotel subsidiaries. The opening of a 176-room hotel in Ocho Rios, Jamaica by the Hilton International Company is a case in point. This company, a wholly-owned subsidiary of Trans World Airlines also opened hotels in several other Caribbean islands. The hotel subsidiaries of Pan American Airways and British Overseas Airways Corporation similarly involved themselves in these islands.<sup>15</sup> The opening of these hotels was apparently motivated by the airlines' desire to ensure that the growth of air traffic and hence the demand for air transportation was not arrested by a lack of accommodation at the tourists' Caribbean destination.

Although such foreign investment eases the pressure on capital in developing countries and releases limited domestic capital for alternative uses which may not attract foreign capital, these countries need not be over-generous in the kinds of incentives they offer to foreign investors. Accompanying such capital from abroad are other factors in short supply in the host country (namely skilled labor and management). In assessing the economic merits of foreign investment to the host country one must therefore consider the extent to which payments to all these imported factors are repatriated to their home country. This matter will be further investigated in the next chapter.

The change in the factor mix in the direction of more capital-intensive tourist activities also implies a change in the distribution of production costs between



the fixed and the variable components. While one cannot equate capital with fixed costs and labor with variable costs,<sup>16</sup> it is reasonable to suggest that as capital intensity increases relative to labor intensity, the ratio of fixed to variable costs of production also increases. Fixed costs have implications for the pricing policy of the tourist firm as will be seen later in this chapter.

It can be said that a competitive supply of tourist facilities characterizes the Jamaican tourist market. The market supply is an aggregate of many firms each of which can be considered a price taker. For although the number of firms (example hotels) in any one region of the island (example Port Antonio, Ocho Rios, or Montego Bay) approximates oligopoly, these regions are close enough geographically (and otherwise) for their prices to be competitive.<sup>17</sup> Further, not only intra-island, but also inter-island competition must be considered, for pricing at any resort will be influenced by pricing at proximate and competitive resorts. Having examined changes in the demand and supply of tourist facilities, it is appropriate to analyze the pricing of such facilities.

#### The Pricing of Tourist Facilities

Given that the tourist industry is competitive in nature, the price of tourist facilities will be determined by the interaction of the demand for, and the supply of these facilities. Changes in demand and supply should in the absence of any artificial restraints on prices bring about the price changes necessary to achieve equilibrium. For instance, if demand increases while supply decreases or remains unchanged, the price should rise by the amount necessary to bring demand and supply into balance.

The direction and magnitude of the price change can be determined for the different combinations of changes in demand and supply—for example, when demand decreases and supply increases simultaneously. In the case of Jamaica the

predominant tendency has been an increase in both demand and supply (rightward shift<sup>18</sup> of these schedules) of tourist facilities over time.<sup>19</sup> This implies that the resulting price change could be either positive, negative, or zero depending on whether the increase in demand is greater than, less than, or equal to the increase in supply. Thus if prices are in fact competitively determined, the rise in price of tourist facilities (as exemplified by higher hotel rates<sup>20</sup>) suggests that demand has been increasing faster than supply in Jamaica as indicated in the preceding section.

Although demand and supply increase over time, supply remains relatively fixed while demand fluctuates in the "short run," such as between winter and summer. In Jamaica the demand for tourist facilities reaches its peak during the winter months and falls off during the summer, so that despite the long-run price increases indicated above, there will be some short-run (seasonal) price decreases as demand decreases in the face of unchanging short-run supply.

The fixity of this supply and the earlier observation linking these facilities with relatively high fixed costs suggest that the tourist firm will sell (rent) these facilities for whatever they will bring provided that the revenue thus derived exceeds the variable cost of operation. Thus hotels for instance, apply off-season and other discriminatory pricing such as special group and individual rates in an attempt to keep demand for their services at relatively high levels, thereby reducing the amount of seasonal excess capacity that would normally develop with peak season prices. Less excess capacity means lower average total cost, for the average fixed cost component will decline as full capacity is approached. Additionally, there may be some scale economies associated with the average variable cost of catering to a larger number of guests as full capacity is approached.

It is conceivable that off-season pricing could serve to lower the general level of prices for some tourist facilities. For instance, if lower prices are used to keep

occupancy rate and profitability of hotel operation relatively high during the off-season, then peak season prices could be reduced, since there would be less pressure to use high peak season prices to help compensate for low profits or any losses which may be realized during the off-season. In this case any emphasis on peak season pricing should be more closely related to the need to use such pricing to ration any scarcity of facilities which might develop at that time.

### Outlook

The changes in Jamaican tourism that were discussed in the foregoing sections of this chapter re-introduce the question of the future trend of that country's tourism. It is appropriate to recall the discussion in Chapter V concerning possible future developments in air transportation and air traffic. Given the tourist character of air traffic to Jamaica and the elasticity of demand associated with this pleasure type of traffic (Chapter III), the future growth of Jamaican tourism will depend largely on what happens to air fares.

Earlier in this study it was argued that increases rather than decreases in air fares will be the pattern in the foreseeable future. Such increases will dampen the growth of tourist traffic to Jamaica, thereby decreasing the demand for Jamaican tourist facilities. This means that (under the competitive setting suggested in the previous section) accommodation rates for instance would fall (relatively), and this could conceivably induce a longer stay<sup>21</sup> by those tourists who go to Jamaica. Should this happen the total number of tourist-days and hence total tourist expenditures in Jamaica over a given period need not decline despite a slowing down of the growth rate of tourists to Jamaica. That is a smaller number of tourists with a larger average length of stay can generate as much or more expenditures than a larger number with a shorter length of stay.

The other possibility is that increases in air fares cut deeper into the vacation budget and shorten the length of stay despite lower rates at the point of des-

tinuation. With a fall in the growth rate of tourists to Jamaica and a shorter average length of stay, a decline in tourist expenditures and in the level of tourist activity is assured. This is not to imply that such a decline would be necessarily harmful to the Jamaican economy. This is an issue which public policy should resolve as will be seen later in this study.

## CHAPTER VI

## NOTES

1. R. J. Voyles, The Tourist Industry of the Caribbean Islands, University of Miami Press, Coral Gables, Florida, 1956, and George E. Cumper, "Tourist Expenditures in Jamaica 1958" in Social and Economic Studies, September 1959, pp. 287-310.
2. The available data on tourist arrivals in Jamaica do not show mode of travel prior to 1956, but they do show the distribution of long-stay and short-stay tourists. The predominance of short-stay tourists (see Table VI-3) suggests that sea traffic (cruise passengers) predominated in those earlier years.
3. This is only a crude approximation of demand, the authenticity of which is challengeable. That is, in a stricter sense these observations should be treated as equilibrium observations, and as such there is an identification problem involved in separating the demand changes. This is an econometric problem requiring separate study.
4. Subject to the earlier observation regarding the problem of identification.
5. Economic and Social Survey of Jamaica (Various Issues).
6. H. Zinder and Associates, Inc., Future of Tourism in the Eastern Caribbean, a report prepared under contract with the Agency for International Development, and sponsored by the Regional Development Agency, May 1969, pp. 38-39.
7. Note however that up to 1974 expenditures did not grow quite as rapidly as traffic (see Chapter V). This can be attributed to the change in the economic status of tourists discussed below.
8. Given a vacation of say two weeks duration, the tourist might decide to spend for instance 7 or 10 or 12 days in Jamaica depending on hotel rates and other prices.
9. That is, those potential travelers at the lower end of the income distribution scale are likely to be more sensitive to price (fare) changes, because the price of an (international) air trip is likely to constitute a relatively large part of their budget. Thus a cut in fares may generate a proportionately larger increase in air traffic and tourism among these consumers.
10. See for example, H. D. Davis, "Potentials for Tourism in Developing Countries," in Finance and Development, Quarterly No. 4, 1968, p. 36; J. B. Lansing, Transportation and Economic Policy, The Free Press, New York, 1966, p. 309; and evidence in Chapter III of this study.
11. These estimates were derived by comparing the relative change in accommodation demanded with the relative change in air fare over the same period. Total accommodation demanded was calculated by multiplying the number of

air transported tourists by the average length of stay (given earlier in this section) to get the number of bed/nights. Air fare data are given in Chapter III.

12. New Commonwealth, Volume 48, No. 1, January 1969, pp. 42-43; No. 2, February 1969, pp. 22-23; and No. 3, March 1969, pp. 33-35.
13. H. Peter Gray, International Travel-International Trade, D. C. Heath and Company, Lexington, Massachusetts, 1970, pp. 21-22.
14. *Ibid.*, p. 22.
15. J. E. Hudson, Connections Between Airlines and Hotels, ITA (Institut Du Transport Aerien) Study, 1969/4E.
16. Some labor might be considered "fixed." For instance, hotels usually maintain a minimum crew of employees round the clock regardless of occupancy rate.
17. In this context competitive prices do not mean identical prices, for facilities such as hotels will usually be characterized by some "product" differentiation (rather than homogeneity) which affords some discretion in pricing.
18. For instance, on the demand side there have been increases in the number of (tourist) consumers of accommodation, and similarly, on the supply side there have been increases in the number of suppliers as evidenced by the entry of airlines into the hotel business.
19. This was true up to 1975 when tourist arrivals in Jamaica started to show a decline. Recall also that since 1976 available accommodation has been declining. This decline has been "due to the fact that a large number of hotel rooms have been pre-empted for other purposes." See National Planning Agency, Economic and Social Survey, Jamaica 1979, p. 13.5.



## CHAPTER VII

### THE ECONOMIC IMPACT OF TOURISM

In the preceding chapter it was shown how air transportation has transformed the nature and magnitude of tourism in Jamaica. This chapter will further investigate the economic significance of that change. Before turning attention to actual measurement of its economic impact, the potential contribution of international tourism to economic development will be examined.

#### The Economic Development Potential of International Tourism

##### Foreign Exchange and Balance of Payments

The potential of international tourism to earn foreign exchange and promote a country's balance of payments position gives that industry particular appeal in developing countries like Jamaica. Increased foreign exchange earnings by the less developed country facilitates more rapid capital accumulation which in turn enhances its rate of economic growth. This is so because an increase in foreign exchange receipts which is furnished by increased exports such as tourism will make the developing country less dependent on foreign loans and grants, "since exports are a form of saving."<sup>1</sup> and therefore a rise in exports implies a rise in saving. Increased saving gives rise to capital accumulation which promotes economic development.

In Prebisch's<sup>2</sup> line of thinking, this is just the type of result that is likely to emanate from a country's emphasis on international tourism. Further, an industry like tourism would exhibit superior performance over the export of primary products in that it would mitigate the secular trend towards the adverse terms of trade facing the less developed countries. Briefly, Prebisch's argument is that the



more economically advanced countries have both a relatively low income and price elasticity of demand for the primary products which the less developed countries traditionally export. On the other hand, the less developed countries tend to exhibit relatively high income elasticity of demand for the import of goods manufactured by the more developed economies. In consequence, the less developed countries tend to experience long-run deterioration in their terms of trade with their more economically advanced trading partners.<sup>3</sup>

Although this argument is plausible, it has not been without challenge.<sup>4</sup> A survey of the pros and cons of Prebisch's thesis would carry this discussion deep into the realms of international trade which is beyond the scope of this manuscript. However, if his thesis is interpreted in terms of the need to develop industries which have greater foreign exchange earning potentials than traditional primary product industries, then international tourism does become an attractive alternative. That is, with the demand for tourism by developed countries (such as the United States and Canada) from the less developed countries (such as Jamaica) being both income and price elastic,<sup>5</sup> the terms of trade of the less developed country would improve as its export of tourism becomes larger relative to its export of primary products.<sup>6</sup> But a note of caution should be added. That is, too much optimism and consequent overemphasis on "new" export industries might endanger the optimum allocation of scarce resources in developing countries. Tourism seems particularly vulnerable to this danger which will be discussed more fully later in this study.

Turning now to what evidence is available on foreign exchange earnings by developing economies, reference is made to Gray's<sup>7</sup> observation. He cautiously concluded on the basis of one year's (1963) data, that the travel industry was not a particularly impressive earner of net foreign exchange for these countries. Notable exceptions were parts of Europe (Greece, Malta, Spain, Turkey, and Yugoslavia),

the Caribbean, and Latin America (including Mexico) where net foreign exchange was observed to show substantial gains.<sup>8</sup>

Some evidence is available on the contribution that tourism makes to the balance of payments position of Jamaica. An examination of that country's current account for the last fifteen years reveals that foreign travel has been the largest positive contributor to that account. Over those years the contribution of foreign travel was on the average about 4.7 times as large as that of private transfer payments<sup>9</sup>—the second largest net contributor to that account.<sup>10</sup>

In developing economies like that of Jamaica, there tends to be persistent deficits in the current account.<sup>11</sup> This is largely explained by the fact that primary products which constitute their major exports are subject to the built-in rigidities of the international agreements through which they are marketed, while capital and other manufactured goods are imported at prices which are always increasing.<sup>12</sup> Tourism is therefore attributed a major role in mitigating the deficits of the current account and thus promoting a more favorable balance of payments position.

The relative importance of international tourism in the balance of payments of the Jamaican economy is further exemplified by the information given in Table VII-1. It will be observed that on the average (over the years 1966-1980) tourism accounted for 15.5 percent of the total receipts on the current account, 16.5 percent of the export of goods and services, and 26.2 percent of the export of merchandise. Some earlier evidence<sup>13</sup> indicates that these percentages for Jamaica are high compared to many other developing countries, thereby suggesting that Jamaica ranks high on the list of countries for whom international tourism constitutes a major credit item on their balance of payments. Attention should however be called to the recent trend in these percentages (Table VII-1) which reflects the declining growth of tourism to Jamaica discussed earlier.

TABLE VII-1

TOURISM VS. OTHER CREDIT CONTRIBUTORS TO THE  
BALANCE OF PAYMENTS OF THE JAMAICAN  
ECONOMY, 1966-1980

| <u>Receipts from Tourism as a Percentage of:</u> |                                      |                                |                           |
|--------------------------------------------------|--------------------------------------|--------------------------------|---------------------------|
| Year                                             | Total Receipts on<br>Current Account | Exports of<br>Goods & Services | Exports of<br>Merchandise |
| 1966                                             | 19.15                                | 20.24                          | 34.34                     |
| 1967                                             | 19.11                                | 20.15                          | 34.94                     |
| 1968                                             | 21.52                                | 22.55                          | 39.20                     |
| 1969                                             | 18.51                                | 19.44                          | 32.03                     |
| 1970                                             | 16.63                                | 17.72                          | 27.92                     |
| 1971                                             | 18.10                                | 19.53                          | 31.73                     |
| 1972                                             | 19.41                                | 21.35                          | 35.68                     |
| 1973                                             | 17.84                                | 19.67                          | 32.41                     |
| 1974                                             | 13.03                                | 13.93                          | 19.74                     |
| 1975                                             | 10.64                                | 11.43                          | 15.85                     |
| 1976                                             | 10.51                                | 11.39                          | 16.64                     |
| 1977                                             | 9.45                                 | 11.03                          | 13.89                     |
| 1978                                             | 11.97                                | 12.27                          | 18.31                     |
| 1979                                             | 13.07                                | 13.84                          | 20.41                     |
| 1980                                             | 12.83                                | 13.19                          | 19.38                     |

Source: Computed from National Planning Agency, Economic and Social Survey of Jamaica, Government Printery, Kingston, Jamaica, (Various Issues).

The contribution of international tourism to the balance of payments position of Jamaica as well as other developing economies would have been greater in the absence of leakages on the importation of goods, equipment, and services demanded by the tourist industry. The major imported items of consumption (and investment), the payment of interest and profits on needed foreign capital (as for hotel construction), and the cost of development programs (advertising and promotion) abroad, all constitute a drain of foreign exchange earned through international tourism.

In the case of Jamaica such a drain accounts for import leakages of about 35 percent<sup>14</sup> of the receipts from international tourism. It is for this reason that net foreign exchange and net balance of payments effects should be emphasized. The optimistic promoter of tourism seems too often inclined to use gross tourist expenditures when referring to the economic contribution and potentials of this industry.

Efforts to lower the "import content" of tourism through import substitution could enhance the net foreign exchange earnings and balance of payments position of these economies. However, the relatively high percentages indicated above should not be interpreted to mean that tourism should necessarily receive increased emphasis or even as much emphasis as it has been receiving. This is a matter for public policy to decide. That is, policy should consider the opportunity cost of the resources allocated to the generation of such foreign exchange earnings, and decide whether the benefits to local residents would be greater if these resources were allocated to alternative uses. The next chapter discusses policy issues in greater details.

### Diversification

The potential contribution of tourism to the economic diversification of the developing country also deserves attention. Diversification has been frequently

prescribed to help promote economic development. Its case is founded on its potential ability to stabilize and/or generate income. As an income stabilizer, diversification spreads economic activity over various lines of endeavor so that adverse economic circumstances in any one line may be absorbed or at least mitigated by activity in the other sectors of the economy. That is, diversification advocates the simple expedient of "not putting all of one's eggs in the same basket." Like other income generators, diversification can give rise to new production thereby activating idle resources (both human and nonhuman) and thus increasing per capita productivity.

Diversification that includes some emphasis on tourism has some merit as both an income stabilizer and an income generator. Despite its seasonal character, tourism contributes to income stability to the extent that it relaxes the dependence on any one sector. This is particularly relevant to the Caribbean area where tourism has helped to relieve the economy of its one-time heavy dependence on a single crop—sugar which has been vulnerable to production hazards, large price fluctuations, and competition from other sources of sugar production developed around the world.

In the area of income generation, tourism stimulates expenditures (visitor, private business, public, etc.) which have a "multiplier effect."<sup>15</sup> Through these expenditures tourism draws on the labor force thereby activating idle resources and alleviating the chronic unemployment problem characteristic of developing countries like Jamaica. In this context must also be seen the potential backward linkages associated with tourism. That is, other industries in responding to the demands made on them by tourism tend to increase their economic activity and thus the amount of employment and income they generate. For instance, agriculture producing larger quantities and better quality of food and raw materials, and industries including construction, manufacturing, furniture, and handicraft may all develop with the tourist trade. Some indication of these backward linkages and the

overall employment contribution of tourism to the Jamaican economy is given below.

Tourism may also be seen as an alternative or supplement to industrialization which orthodox theory advocates as an economic development strategy. While industrialization helps to stabilize and generate income and employment, tourism may go one step further by providing badly needed foreign exchange which other industries are less capable of earning. This seems particularly likely if the products of industrialization are mainly for domestic consumption, and have little or no ability to substitute imported goods. The foreign exchange earned by international tourism can be used to acquire the capital goods necessary to speed up the development process.

Too great an emphasis on tourism could however defeat the goal of economic diversification which tourism is intended to foster. That is, such an emphasis would merely shift the economy's dependence unto this industry instead of helping to distribute the risk over alternative economic endeavors. Thus in order to be effective as a means of diversification, tourism should supplement rather than replace other industries. Moreover, despite its potential as an alternative which helps to diversify the economy, tourism would be receiving unwarranted emphasis if opportunity costs suggest that there are superior alternatives to which such emphasis should be directed.

### Employment

Given the service-oriented character of tourism and the chronically high rate of unemployment<sup>16</sup> in Jamaica, it is appropriate to investigate the employment contribution of tourism to that economy. Precise determination of the total amount of employment generated by tourism is a tall order, since much of this employment is indirect. Any estimate of the contribution of tourism to employment is therefore questionable.



Table VII-2 shows the number of employees in tourism as a percent of the labor force. It will be observed that excepting for the four most recent years, this percentage generally tended to increase over most of the period, thereby suggesting that tourism has become more important as an employment generator in the Jamaican economy.<sup>17</sup> This can be interpreted as a reflection of the change in the nature of Jamaican tourism discussed in the preceding chapter. That is, with the growth of air traffic relative to sea traffic, and the longer stay of the air transported tourist, relatively more employment is generated in the provision of goods and services required by the longer staying tourist.

The employment impact of tourism will be disseminated in the economy in accordance with the backward linkages to other industries indicated above. Some indication of the nature of these backward linkages is given by the pattern of tourist spending in the Caribbean, (see Table VII-3). As these data indicate, there is potentially strong backward linkage to the agricultural and construction industries given the expenditures on food and accommodation.<sup>18</sup> However, in the case of Jamaica these linkages are weakened by the high import content of Jamaican tourism indicated earlier.

One of the merits claimed<sup>19</sup> for the backward linkages associated with tourism is that these linkages "are readily adaptable to labor-intensive technology and are therefore employment-creating and capital-saving." This raises the related question of the labor intensiveness of tourism. Advocates of an expanded tourist industry seem frequently inclined to impute a highly labor-intensive character to tourism, thereby suggesting its importance in labor surplus economies like Jamaica. But such advocates tend to overlook the capital required to generate those jobs.

Hotels and the related infrastructure account for a major share of that capital requirement. For instance, it was estimated<sup>20</sup> that it took about \$20,000 of capital to generate one hotel job in Puerto Rico. While this capital requirement



TABLE VII-2

ESTIMATED PROPORTION OF THE LABOR FORCE  
EMPLOYED IN TOURISM, JAMAICA, 1960-1980.

| (1)  | (2)        | (3)                      | (4)                                                         | (5)                  |
|------|------------|--------------------------|-------------------------------------------------------------|----------------------|
| Year | Population | Labor Force <sup>a</sup> | Estimated Number <sup>b</sup><br>of Employees in<br>Tourism | (4) as a<br>% of (3) |
| 1960 | 1,628,200  | 651,280                  | 9,210                                                       | 1.4                  |
| 1961 | 1,633,400  | 653,360                  | 10,136                                                      | 1.6                  |
| 1962 | 1,659,800  | 663,920                  | 11,208                                                      | 1.7                  |
| 1963 | 1,696,500  | 678,600                  | 11,346                                                      | 1.7                  |
| 1964 | 1,762,000  | 704,800                  | 11,034                                                      | 1.6                  |
| 1965 | 1,811,000  | 724,400                  | 11,910                                                      | 1.6                  |
| 1966 | 1,859,000  | 743,600                  | 12,376                                                      | 1.7                  |
| 1967 | 1,893,000  | 757,200                  | 13,368                                                      | 1.8                  |
| 1968 | 1,923,000  | 769,200                  | 14,424                                                      | 1.9                  |
| 1969 | 1,863,700  | 754,480                  | 16,424                                                      | 2.2                  |
| 1970 | 1,890,700  | 756,280                  | 20,514                                                      | 2.7                  |
| 1971 | 1,911,400  | 764,560                  | 23,535                                                      | 3.1                  |
| 1972 | 1,953,500  | 781,400                  | 26,916                                                      | 3.4                  |
| 1973 | 1,990,900  | 796,360                  | 29,847                                                      | 3.7                  |
| 1974 | 2,025,000  | 810,000                  | 32,928                                                      | 4.0                  |
| 1975 | 2,060,300  | 824,120                  | 33,375                                                      | 4.0                  |
| 1976 | 2,084,500  | 833,800                  | 35,913                                                      | 4.3                  |
| 1977 | 2,109,400  | 843,760                  | 31,161                                                      | 3.7                  |
| 1978 | 2,137,300  | 854,920                  | 26,820                                                      | 3.1                  |
| 1979 | 2,160,900  | 864,360                  | 25,779                                                      | 3.0                  |
| 1980 | 2,187,900  | 875,160                  | 25,449                                                      | 2.9                  |

Source: Computed from National Planning Agency, Economic and Social Survey of Jamaica (Various Issues), Government Printery, Kingston, Jamaica.

<sup>a</sup> Assumed to be 40 percent of total population, based on information given Economic and Social Survey of Jamaica (Various Issues).

<sup>b</sup> This study estimated that about 3 jobs are generated by each hotel room. This estimate was derived by comparing the number of hotel beds (and rooms) with the estimated number of employees (direct and indirect) in tourism, as reported in Economic and Social Survey of Jamaica (Various Issues). This estimate is supported by one derived for another Caribbean economy, (see Government of Trinidad and Tobago, Third Five-Year Plan, 1969-1973, Government Printery, Port-of-Spain, Trinidad, 1970).

TABLE VII-3  
ESTIMATED DISTRIBUTION OF TOURIST EXPENDITURES  
IN THE EASTERN CARIBBEAN

| Expenditure Category | Percent of Total Expenditure |
|----------------------|------------------------------|
| Food and Drinks      | 38.5                         |
| Accommodation        | 31.5                         |
| Purchases            | 15.0                         |
| Sightseeing          | 15.0                         |
|                      | 100.0                        |

Source: H. Zinder and Associates, The Future of Tourism in the Eastern Caribbean, Washington, D. C., 1969, p. 37.

per employee was no greater than for light industry, the capital requirement per additional job in related service industries was much less than that for the hotel job. Thus when such other services as maintenance work, taxi-driving, catering, and travel agencies were included, the capital requirement per job in the tourist sector declined by 35 percent to \$13,000.<sup>21</sup>

Another study<sup>22</sup> estimated that it took about \$10,000 to \$15,000 (U. S.) of capital to create one full-time job in the hotel sector in the Commonwealth Caribbean. That study then questioned any inference that tourism has special advantage in creating employment, given the relatively capital-intensive infrastructure and other related investment required to establish the tourism sector.

It will be recalled that it was observed (Chapter VI) that as the less developed countries expand their tourist industry and cater to a larger proportion of visitors from the more developed, relatively capital-abundant countries, that this could cause the tourist industry in these developing economies to be more capital-intensive than the average of all other industries. While the above evidence does not completely support that contention, it does suggest that tourism in the less developed countries might not be as labor-intensive as is generally assumed. It further points to the public policy question of how effective this scarce factor (i.e., capital) is in generating employment, and whether it warrants the foreign exchange cost that might be necessary for instance in the importation of equipment and materials for hotel construction. This matter will receive further attention in the next chapter.

#### Measuring the Economic Impact of Tourism

The determination of the contribution of tourism to an economy is not a simple matter and the results obtained are at best approximations. This is so because the indirect nature of some of the effects and their wide diffusion through

the economy make it difficult to sort out the economic impact of tourism. One approach to these approximations is the use of multiplier analysis which is briefly reviewed below.

In essence, this multiplier analysis is an attempt to determine the income generated by original tourist spending as these dollars move through the economy. A part of the tourist dollars spent in the host country becomes income to some of that country's residents who in turn spend a part or all of that income which becomes income to others who continue this chain of spending and respending. Each succeeding round of spending generates less income due to leakages (imports, taxes, savings) until ultimately this spending approaches zero. The sum of these rounds of spending divided by the original tourist expenditure produces a quotient which is the so-called tourist multiplier.

It is appropriate to state the assumptions on which such multiplier analysis is based. One important assumption is the existence of local unemployed resources which can be readily exploited to satisfy the increased demand generated by the successive rounds of spending initiated by the original tourist expenditure. Related to this is the assumption that the increased demand thus generated does not produce inflation so that the rise in national income attributed to tourist expenditures is a real increase. This assumed absence of inflation is further related to another assumption, namely, that the impact of tourist expenditures is non-regressive in so far as the distribution of income within the local economy is concerned. The implications of these assumptions will be discussed later when a critique of the multiplier concept will be undertaken.

Various studies have estimated tourist multipliers for the Caribbean and other regions or countries of the world. These studies have produced multipliers ranging from 0.60 to 8.4 (Table VII-4). Such a wide range can be explained by differences in assumptions relative to different geographic areas, differences in the kind of data

TABLE VII-4

ESTIMATED TOURIST MULTIPLIERS FOR DIFFERENT COUNTRIES  
DERIVED BY SEPARATE STUDIES

| Country or Area                      | Estimated Tourist Multiplier | Time of Study |
|--------------------------------------|------------------------------|---------------|
| Greece <sup>a</sup>                  | 1.2 - 1.4                    | 1964          |
| Ireland <sup>a</sup>                 | 2.7                          | 1966          |
| Lebanon <sup>a</sup>                 | 1.2 - 1.4                    | 1967          |
| Pacific and Far East <sup>a, b</sup> | 3.2 - 4.3                    | 1961          |
| Hawaii <sup>a</sup>                  | 0.9 - 1.3                    | 1963          |
| New Hampshire <sup>a</sup>           | 1.6 - 1.7                    | 1962          |
| Pakistan <sup>a</sup>                | 3.3                          | 1965          |
| Yugoslavia <sup>b</sup>              | 8.4                          | 1966          |
| Eastern Caribbean <sup>b</sup>       | 2.3                          | 1969          |
| Eastern Caribbean <sup>c</sup>       | 1.27                         | 1970          |
| Eastern Caribbean <sup>d</sup>       | 0.60 - 0.88                  | 1971          |

Sources: <sup>a</sup>International Union of Official Travel Organizations, Economic Review of World Tourism, 1968, p. 26.

<sup>b</sup>H. Zinder and Associates, The Future of Tourism in the Eastern Caribbean, a report prepared under contract with the Agency for International Development, and sponsored by the Regional Development Agency, May 1969.

<sup>c</sup>Kari Levitt and Igbal Gulati, "Income Effect of Tourist Spending : Mystification Multiplied : A Critical Comment on the Zinder Report," Social and Economic Studies, Volume 19, No. 3, 1970, p. 337.

<sup>d</sup>John Bryden and Mike Faber, "Multiplying the Tourist Multiplier," Social and Economic Studies, Volume 20, No. 1, 1971, p. 69.

used, and differences in analytical apparatus. Much criticism<sup>23</sup> has been directed to the methods of analysis which has produced such relatively large multipliers as 2.3 for the Eastern Caribbean, 2.3-4.3 for the Pacific and Far East, and 8.4 for Yugoslavia. A brief examination of this analytical approach which is exemplified by the Zinder study<sup>24</sup> of the Caribbean is in order.

That study assumed an initial tourist expenditure of \$1,000 being spent on accommodation (\$315), food and drink (\$385), purchases (\$150) and sightseeing (\$150). With the help of flow charts showing a number of transactions, Zinder estimated the "total spending" (\$2,300) resulting from the \$1,000. Dividing this total spending by the initial tourist expenditure produces a quotient (2.3) which he calls the multiplier.

The basic objection to this method lies in his transactions approach to the derivation of the multiplier. In using this method, Zinder confuses total spending which is derived from summing a number of transactions, with the addition to national income. For instance, he apparently regards the \$315 initially paid for accommodation by the tourist, as "income" which is added to his other rounds of "income" in estimating the total impact of the initial tourist expenditure. But not until the hotelier pays this out in such forms as wages, salaries, interest, and rent does it become anybody's income. Thus an error of double counting is committed when payment by the tourist to the hotelier and the subsequent paying out of this same amount by the hotelier (as wages, salaries, etc.) are regarded as two separate rounds in the multiplier process. This introduces an early upward bias in the size of the multiplier.

What Zinder has really summed up and regarded as addition to national income (\$2,300) is nothing more than the total of dollars changing hands through a number of transactions. To obtain a more realistic estimate of the impact of the initial tourist expenditure on national income, one should add up the successive



incomes received by nationals and not the successive gross receipts as done by Zinder.<sup>25</sup> That is only the "value added"<sup>26</sup> at each stage of the process should be summed to arrive at the addition to national income. It is this sum that should be divided by the initial tourist expenditure to determine the income multiplier which will necessarily be smaller than Zinder's "multiplier."

#### Limitations of the Multiplier Concept

In general, the income multiplier as applied to the less developed countries has fallen into disrepute. Thus it is argued<sup>27</sup> that the Keynesian type multiplier is appropriate for analyzing a developed economy with unemployed resources, under which circumstances an increase in aggregate demand will increase income in a multiplied fashion. This might not be the case in less developed economies like that of Jamaica. There, an increase in tourist expenditure for instance may generate additional demand which cannot be satisfied from the short-run supply potential of the economy despite the relatively high levels of unemployment; for although labor might be abundant, other production factors complementary to labor might be either scarce or unavailable for use. For instance, the scarcity of capital and the "imperfect" ownership and control of land will restrict the employment of labor and the production of local goods (and services), so that the increase in aggregate demand which is generated by tourist expenditures may result in inflation and increased import leakages rather than a rise in domestic output and income.

Related to the above argument is the implication of the tourist multiplier impact for income distribution; but before pursuing this matter, the caveat should be issued that the income distribution arguments offered below should not be oversold. Professor P. S. Dhruvarajan in communication with this writer has commented that the host country can implement policy to redistribute income, and therefore the burden of redistribution should not be placed on the industry. With that in mind, the arguments presented here would be plausible only in a context of non-existent or passive public policy regarding this matter.

In developing countries like Jamaica there is a general tendency for income to be concentrated in relatively few hands. That is, in these countries the top 20 percent of income recipients generally receive 50 percent or more of total national income.<sup>28</sup> Inequality of such magnitudes suggests the relevance of calling public policy attention to this matter. Thus while tourism or any other industry should not be expected to solve the problem, it could in the absence of active or effective income distribution policy contribute to the results indicated below.

One When tourism draws more heavily on the large body of unskilled than on the relatively few skilled workers,<sup>29</sup> it will tend to have a positive income distribution effect to the extent that it increases the earnings and mitigate the unemployment problem of those on the lower end of the income scale. If the converse were the case however, the income distribution effect would likely be negative for analogous reasoning. Again, there may be some price inflation if the increase in aggregate demand comes from the relatively few skilled earning higher incomes which are not matched by a rise in domestic production, while the unemployment of unskilled labor remains high.

It might be argued that such a negative effect on the distribution of income (that is the tendency towards greater inequality in incomes) may tend to limit the economic impact of tourism, for it would leave income and purchasing power in fewer (the skilled) hands instead of distributing it to more spenders (the unskilled) where the impact may be greater. This argument incorporates the assumption that marginal propensity to consume tends to fall with rising income,<sup>30</sup> so that greater equality in the distribution of income will tend to promote a stimulative effect on the economy. The assumption that imports tend to rise with income further discredits a negative income distribution effect, for this implies increased leakages on imports, thereby decreasing the multiplier impact.

On the other hand, a case can be made for the negative distributive effect indicated above. When more of the tourist-generated income goes to the relatively

rich than the poor, this might increase domestic saving by the rich, and if this saving is channelled into investment, national income will increase via the multiplier. Thus the ultimate economic impact of tourism need not be limited (and might even be enhanced) by an income distribution effect which favors the rich.

### Social Marginal Productivity

The above criticisms of the tourist multiplier suggest that some other framework might be more useful for analyzing the impact of tourism on an economy. One alternative which has appeal is the social marginal productivity<sup>31</sup> (SMP) criterion. This criterion is appealing for a number of reasons.<sup>32</sup>

Firstly, it is a more comprehensive framework than the "partial" multiplier analysis. The SMP permits analysis of the economic potential of the tourist industry in terms of capital intensity, balance of payments effects, the social profitability of investment in the industry, the ratio of foreign to domestic investment, and the ratio of imported to domestic inputs.

Secondly, the analytical emphasis on capital and balance of payments which the SMP permits makes the application of this framework particularly relevant to developing economies like that of Jamaica. That is, in developing economies capital and balance of payments are two factors of vital concern.

Thirdly, the SMP framework utilizes the concepts of social costs and values and therefore it theoretically encompasses externalities. This matter of divergences between social and private costs and benefits need particular attention in developing economies. In the more economically advanced countries, resources are fairly well allocated by market forces under relatively competitive conditions.<sup>33</sup> This allocation is based largely on the microanalytical criterion of marginal productivity which measures the productivity of the last unit of investment in each sector from the viewpoint of the firm's profitability.

In the less developed countries, however, the allocation of resources through the price system is often distorted because factor employment is characterized by

some structural disequilibrium associated with abundant labor, and scarce capital and foreign exchange.<sup>34</sup> Thus factors may not be paid their shadow price. For instance, if labor is abundant and unemployment consequently high (as in Jamaica), the shadow price of labor (interpreted as its marginal productivity) is likely to be low and perhaps approaches zero. This would make the wage rate correspondingly low if labor is to be paid its shadow price. However, in practice the payment to labor is not near a zero wage rate as its opportunity cost would suggest, because of such institutional factors as unionization and minimum wage legislation. The wage rate (market price of labor) might therefore not be a true reflection of labor's scarcity and might consequently over state the real cost of labor. For these reasons, social (rather than private) marginal productivity is the more appropriate measurement criterion. This criterion will be discussed and applied below.

Following Chenery,<sup>35</sup> the social marginal productivity (SMP) is given by the following formula:

$$SMP = \left( \frac{V}{K} \right) \left( \frac{V-C}{V} \right) + r \frac{B}{K} \quad (1), \text{ where}$$

SMP measures the average annual increment in national product from the marginal unit of investment. Note that the variables in the equation (except K) are annual flows.

V = social value added domestically. This is defined as the sum of the increased market value of output and the added value of output due to external economies, minus the cost of imported materials.

K = increment to capital (investment).

C = the total cost of domestic factors excluding capital cost.

B = total balance of payments effect. This includes the effect of the installation of the investment project and of operating the project on balance of payments.

$r$  = a premium attached to foreign exchange earning or saving. When no premium is attached to foreign currency,  $r$  equals unity.

From the above formulation the following relationships are defined.

$\frac{V}{K}$  = the rate of capital turnover or the inverse of capital intensity (i.e., the output/capital ratio).

$\frac{V-C}{V}$  = the value margin. It is a measure of social profitability which is the value added to net national product by the investment  $K$ .

$\frac{B}{K}$  = the balance of payments effect whose importance depends on the parameter  $r$ .

The Chenery equation has been modified<sup>36</sup> to produce a formulation of the SMP which has particular relevance to international tourism. This variant of Chenery's formulation is as follows:<sup>37</sup>

$$SMP = r \left( \frac{V_i}{K_i + K_d} \right) \left( \frac{V_i - M_i - \frac{1}{r} C_d}{V_i} \right) + K_i (r-1) \quad (2)$$

where the subscripts  $d$  and  $i$  represent domestic and international, respectively.  $M_i$  represents imports used directly in  $V_i$ . Included in these imports are payments to foreign-owned factors (interests, profits, and wages to non-nationals) which are remitted overseas. Therefore, the SMP is multiplied by  $r$ , the premium attached to foreign exchange earning or spending. This premium must also be used to discount domestic costs. The second term<sup>38</sup> in the equation allows for the inclusion in the SMP of the premium on foreign capital which is attracted into the host country. It is assumed that no sales are made to residents of the host country so that  $V_d = 0$ .

From the equation of the social marginal product, it will be observed that the higher the rate of capital turnover, or conversely the lower the capital intensity, the larger will be the SMP ceteris paribus. Similarly, the higher the value margin and the higher the premium attached to foreign exchange the larger will be the SMP. Further, for a given  $r$ , the higher the ratio of foreign to domestic investment the larger will be the SMP.<sup>39</sup> It will be noted that differences in this ratio will not



affect the capital intensity or rate of capital turnover, but it will affect the "additive" (second) term in the equation so that SMP will increase and decrease with  $K_1$ .

The scarcity of capital in the less developed countries suggests the need to emphasize projects which have a high rate of capital turnover or low capital intensity. Investment in the tourist industry tends to be relatively capital intensive<sup>40</sup> especially when supporting infrastructural development must be undertaken. But although such infrastructure tends to have a high initial cost, its marginal cost tends to be relatively low. The cost of infrastructure is thus reduced by concentrating travel facilities in particular areas of the country. Such a concentration is exemplified in Jamaica where tourism and related facilities flourish along the north coast of the island.

The availability of foreign capital helps to mitigate the scarcity of domestic capital in developing countries. In some cases, such foreign capital is restricted to particular uses as in the case of direct foreign investment into tourism. This, however, is not a serious limitation if the host government maintains appropriate control and applies to such investment conditions which are mutually satisfactory to the foreign investors and the host country.

When foreign capital is available, the capital intensity of the project measured in terms of domestic capital will be relatively low. This permits the host country to divert attention from the capital intensity to the value margin or social profitability of the project. From the modified SMP equation given above, it is seen that the cost of foreign capital (in the form of remittances abroad) is contained in the value margin. Therefore this cost will be an important determinant of the size of the value margin. The policy implications of this cost and other determinants of the value margin will be investigated later in this study. The use of domestic resources saves on foreign exchange and therefore the cost of



these resources must be discounted by the premium attached to foreign exchange savings (or earnings). This enhances the value margin of the project.

The numerical value of the premium ( $r$ ) attached to foreign exchange indicates the importance of the balance of payments effect of the investment. Values of  $r$  greater than unity indicate a deficit in the country's balance of payments. Thus larger values of  $r$  indicate more severe balance of payments deficits than smaller values of  $r$ . For most developing countries the value of  $r$  is likely to be greater than unity since these countries typically<sup>41</sup> suffer a deficit in their balance of payments. For instance, the Jamaican economy showed a deficit in its balance of payments for 14 of the 19 years (1962-1980).<sup>42</sup> Thus for these countries the earning or saving of foreign exchange will enhance the social marginal productivity of an investment project. The relationship between  $r$  and the SMP was discussed above, and is presented in tabular form later in this section.

One limitation of the SMP criterion is the absence of the time element in its framework. Account should be taken of the construction time, the gestation period and the rate of depreciation of the project. This requires some present value discounting of the project's future yield and cost. But the determination of present values raises the question of the choice of the discount rate<sup>43</sup> to be employed. The discount rate should reflect the shadow price or the opportunity cost of the resources allocated to the project. This opportunity cost is measured in terms of the percentage rate of return that such resources would yield in their best alternative use. The discounting of future returns and the balance of payments premium<sup>44</sup> together will have the effect of reducing the average productivity of long-term projects, and could therefore help to eliminate some potentially unprofitable investment.<sup>45</sup>

#### An Application of the SMP Framework

What follows is an attempt to apply Gray's modification (Equation 2) of Chenery's formulation (Equation 1) of the SMP criterion to tourism in Jamaica.

The investment project<sup>46</sup> to be evaluated consists of a hotel of one hundred rooms together with the requisite infrastructural development. The variables in the equation were estimated as follows:

$V_i =$  \$664,300 (U. S.) represents the annual sales<sup>47</sup> to nonresident tourists. This is approximated by tourist receipts (expenditures) attributed to the hotel project. It is assumed that the availability and occupancy of this hotel are associated with a net addition of visitors (tourists) rather than a loss of guests to previously existing hotels. An hotel of 100 rooms should have 36,500 room-days available per year. Assuming a 52 percent<sup>48</sup> occupancy rate, this would mean 18,980 room-days sold by this hotel. With an estimated room-day (visitor day) expenditure of \$35 (U. S.),<sup>49</sup> the total annual tourist receipts (expenditures) generated by this hotel<sup>50</sup> would be \$664,300 (U. S.).

$M_i =$  \$232,505 was estimated at 35 percent<sup>51</sup> of the tourist expenditures.

$C_d =$  \$74,733.6 was derived by first taking domestic labor cost (wages and salaries) as a proxy<sup>52</sup> for the cost of domestic factors (excluding capital). This cost amounts to \$124,536<sup>53</sup> at market prices. With an assumed shadow wage rate of 60 percent<sup>54</sup> of the market (actual) wage the real cost is estimated to be \$74,733.6.

$K =$  \$2,535,000 U. S. This estimate was derived by assuming an investment cost of \$15,000 (U. S.) per room for a 100 room hotel project (\$1,500,000), plus related infrastructural investment cost of 69 percent of the direct investment in the hotel (\$1,035,000). This assumption is based on various estimates<sup>55</sup> ranging from \$12,000 to \$40,000 (eastern Caribbean \$) per room together with related infrastructural costs. This K value can be decomposed into foreign capital  $K_i = \$1,901,250$  and domestic capital  $K_d = \$633,750$ .<sup>56</sup>

- $r \Rightarrow$  1. This study assumes  $r$  values ranging from 1 to 2. This assumption is based on the earlier discussion with respect to the relationship between the size of  $r$  and the country's balance of payments position. In that discussion some evidence was given on the Jamaican balance of payments experience. The use of a range of  $r$  values will give some indication of the sensitivity of the SMP to the premium attached to foreign exchange.

Table VII-5 shows that the SMP per unit of investment ranges from 0.14 to 1.06 depending on the value of  $r$ . It is seen that the SMP value is relatively low when the value of  $r$  is low, but that it rises relatively rapidly as  $r$  increases. That is, ceteris paribus, an increase in  $r$  gives rise to a greater than proportionate increase in the SMP of investment in Jamaican tourism.

As indicated earlier, a value of  $r = 1$  assumes no premium<sup>57</sup> is attached to foreign exchange earning or saving. Values of  $r$  greater than unity indicate the extent to which the domestic currency is overvalued and the relative severity of deficits in the balance of payments. For instance, a value of  $r = 1.20$  assumes a 20 percent overvaluation of the national currency and a relatively minor deficit problem with the balance of payments. By contrast, a value of  $r = 2.0$  assumes that the true value of foreign exchange to the economy is twice the existing rate of exchange, thereby suggesting relatively severe deficit in the economy's balance of payments.<sup>58</sup>

The SMP values are ratios of the average annual<sup>59</sup> increments in national income to a unit of investment. Thus in Table VII-5 an SMP value of 0.14 for instance indicates that a dollar invested in tourism would contribute an average of 14 cents per year over the life of the project if the country's balance of payments position is relatively close to equilibrium. Similarly, the annual contribution to national income per dollar of investment would be \$1.06 if the country suffers from

TABLE VII-5

SOCIAL MARGINAL PRODUCTIVITY ESTIMATES OF A TOURIST  
INVESTMENT PROJECT, JAMAICA, WEST INDIES

| Tourist<br>Receipts<br>$V_i$ | Foreign<br>Capital<br>$K_i$ | Domestic<br>Capital<br>$K_d$ | Imports<br>$M_i$ | Cost of<br>Domestic<br>Factors<br>$C_d$ | Foreign<br>Exchange<br>Premium<br>$r$ | Social<br>Marginal<br>Product<br>SMP |
|------------------------------|-----------------------------|------------------------------|------------------|-----------------------------------------|---------------------------------------|--------------------------------------|
| \$664,300                    | \$1,901,250                 | \$633,750                    | \$232,505        | \$74,733.6                              | 1.00                                  | 0.14                                 |
| 664,300                      | 1,901,250                   | 633,750                      | 232,505          | 74,733.6                                | 1.20                                  | 0.33                                 |
| 664,300                      | 1,901,250                   | 633,750                      | 232,505          | 74,733.6                                | 1.40                                  | 0.51                                 |
| 664,300                      | 1,901,250                   | 633,750                      | 232,505          | 74,733.6                                | 1.60                                  | 0.69                                 |
| 664,300                      | 1,901,250                   | 633,750                      | 232,505          | 74,733.6                                | 1.80                                  | 0.88                                 |
| 664,300                      | 1,901,250                   | 633,750                      | 232,505          | 74,733.6                                | 2.00                                  | 1.06                                 |

Source: Estimates and equations given above.

relatively severe and chronic deficits in its balance of payments. Thus on the basis of these SMP values, a case for investment in tourism would be made stronger the more severe the economy's balance of payments problem.<sup>60</sup>

The sensitivity of the SMP to  $r$  indicated above, suggests that the balance of payments effect is an important determinant of the SMP. However, this does not necessarily qualify the balance of payments effect as the deciding factor in determining investment priorities. The other terms (namely, capital turnover and value margin) in the SMP equation are also sub-criteria with which public policy should be concerned in the allocation of scarce resources to any project. Thus from a policy viewpoint, some weight should be assigned to each term in the formula when applying the SMP criterion.

It should be emphasized that the values of the SMP here derived are not definitive but only illustrative of the approximate assessment that can be made of investment in tourism. No one of the values included in Table VII-5 does by itself give a complete picture of how well tourism performs in the economy. Any one of these values would however be useful in setting up investment priorities and allocating scarce investment resources among different industries.<sup>61</sup> For instance, an SMP value of 1.06 in tourism, 1.20 in bauxite, and 0.95 in sugar production would indicate that ceteris paribus, tourism should have priority over sugar but not over bauxite when resources are to be allocated to these industries. That is, all feasible bauxite projects should be exploited before a dollar of investment is made in tourism.

It will be recalled that in the above analysis investment in tourism included both foreign and domestic capital. The point should be made that from the standpoint of the host country (Jamaica in this case), the primary concern should be the opportunity cost of the domestic component of such investment. The opportunity cost of the foreign capital involved is a matter of concern for the foreign investor

who will decide whether he should invest in tourism or some other industry, and whether in Jamaica or some other country.

It should also be noted that although the tourist industry was earlier characterized as being relatively capital-intensive, compared to other industries, it is more attractive to foreign capital because of its direct linkage with foreign exchange earnings associated with investment in major international hotels and related tourist facilities. However, despite the inflow of such foreign capital, there will still be substantial domestic capital investment involved in the provision of related infrastructure and utilities. One might say that such domestic (government) investment is "induced" or perhaps even dictated by foreign investment given the generally responsive attitude and liberal concessions extended by some host governments to foreign investors.

Earlier in this chapter the domestic capital requirement was estimated at about 25 percent of the total investment in hotels. Alternatively stated, every three dollars of foreign investment in tourism necessitate one dollar of domestic investment.<sup>62</sup> Thus even if all hotels were foreign-owned, the tourist industry would still make substantial demands on the host country's (Jamaica's) scarce capital. Moreover, there has been increased ownership in hotels by the Jamaican Government in recent years. For example, in 1976 the Government had "an interest in 30.3 percent or 2849 of the total number of hotel rooms."<sup>63</sup> By 1981 the Government through National Hotels and Properties Limited (a wholly owned subsidiary of the Urban Development Corporation) gained majority interest in 44 percent of the total hotel rooms in the six major tourist resort areas of the island.<sup>64</sup> Table VII-6 provides further details.

These data indicate that domestic investment is gaining prominence in the Jamaican tourist industry, and therefore the allocation of domestic capital to that industry is on the rise. This trend should be allowed to continue only if the capital



TABLE VII-6  
GOVERNMENT-OWNED HOTEL CAPACITY,  
JAMAICA, WEST INDIES, 1981

| Hotel                                        | Room<br>Capacity | Percent<br>Owned by<br>Government |
|----------------------------------------------|------------------|-----------------------------------|
| Royal Caribbean Hotel                        | 168              | 100                               |
| Hotel Intercontinental Ocho Rios (Americana) | 357              | 100                               |
| Mallards Beach-Hyatt (Sheraton)              | 397              | 100                               |
| Negril Beach Village                         | 280              | 100                               |
| Casa Montego Hotel                           | 129              | 100                               |
| New Kingston Hotel <sup>a</sup>              | 200 (400)        | 100                               |
| Rose Hall Holiday Inn                        | 481              | 100                               |
| Rose Hall Intercontinental                   | 516              | 100                               |
| Runaway Bay Hotel                            | 155              | 100                               |
| Montego Beach Hotel                          | 139              | 100                               |
| Inn on the Beach                             | 46               | 92                                |
| Hotel Intercontinental-Kingston <sup>a</sup> | 111 (388)        | 95                                |
| Trelawny Beach Club                          | 350              | 74                                |

Source: National Planning Agency, Economic and Social Survey of Jamaica, 1981, The Government Printer, Kingston, Jamaica, 1981, Table 15.1.

Notes: <sup>a</sup>New Kingston Hotel operates 200 rooms although total room capacity is 400. Hotel Intercontinental operates 111 rooms although total room capacity is 388.

thus allocated to the tourist industry could not be more efficiently employed in alternative investment projects. Such a determination can be made with the help of social marginal productivity analysis.

### The Multiplier Revisited

The preceding discussion of social marginal productivity suggests that it is a useful framework for determining investment priorities. However, until such ranking of investment projects is accomplished, policymakers and some analysts will no doubt continue to employ the "popular" though frequently deficient multiplier analysis. It might therefore be useful to derive some estimate of the economic impact of international tourism within that context. This will now be attempted with focus on the Jamaican experience.

The framework employed below is simple and is not free of limitations. However, because it is more comprehensive, it should produce more realistic estimates than the multiplier analysis discussed earlier; and it should therefore be a better guide to public policy than some other simple techniques which have produced exaggerated results of the type criticized earlier in this chapter. The following discussion<sup>65</sup> provides more details.

For purposes of this analysis, it is appropriate to begin by reviewing the simple Keynesian multiplier approach to income generation in an open economy. This can be represented in symbolic form as follows:

$$Y = \frac{X}{1-c(1-m)} \quad (3)$$

where  $Y$  = income generated.

$X$  = "autonomous expenditure."

$c$  = marginal propensity to consume.

$m$  = marginal import coefficient.<sup>66</sup>

Since  $m$  represents the fraction of domestic demand which is met by imports, it follows that  $1-m$  is the fraction met from local factors of production. The above

formula should be interpreted to mean that local residents receive an initial payment of \$X which through a chain of spending and re-spending will be multiplied up  $\frac{1}{1-c(1-m)}$  times to generate total income of \$Y.

By contrast, an expenditure (payment) of \$X by tourists visiting an open economy does not result in initial receipts of \$X by local residents. Of the \$X spent by tourists some will "immediately" leak out of the host country for imports required by the tourist industry, and therefore those (leaked) dollars will not constitute payment to local factors of production.<sup>67</sup> Thus in determining the total income generated by a given amount of foreign tourist expenditures, that portion that initially leaks out to satisfy tourist demand must first be subtracted to find the remaining portion which will be subjected to the chain of spending and re-spending.

Furthermore, the portion which is received by local residents must also be adjusted for import leakages associated with the demand by the local population. In symbolic form, the total income generated when these adjustments are made is given by:

$$Y = \frac{(1-m_i) X_i}{1-c(1-m_d)} \quad (4)$$

where the subscripts i and d refer to international (foreign) tourists and domestic population respectively, and the other symbols are as previously defined. Note that the total income generated by each dollar of expenditure would be smaller in this case than that indicated by Equation (3) because the multiplier is smaller. That is,

$$\frac{1-m_i}{1-c(1-m_d)} < \frac{1}{1-c(1-m)}$$

Using what data were available, the following crude estimates were derived<sup>68</sup> relative to Jamaica:

$$m_i = 0.35 ; m_d = 0.32 ; c = 0.91.$$

Substituting these estimates into the relevant formula indicated above, a multiplier value of  $k = 1.71$  was obtained; that is,  $k = \frac{(1-0.35)}{1-0.91(1-0.32)} = 1.71$ . By contrast, the multiplier value would be 2.63 without adjustment for the initial leakage of tourist dollars (expenditures) which are not received by local factors of production; that is,  $k = \frac{1}{1-0.91(1-0.32)} = 2.63$ . It is this larger ("unadjusted") multiplier derived in the manner indicated above, that would presumably be employed by analysts and policymakers who are over-zealous about the expansion of the Jamaican tourist industry. The likely consequence is that the economic impact of tourism tends to be exaggerated.

In Table VII-7 the income to Jamaican nationals generated by tourist expenditures was estimated by employing the multipliers of 1.71 and 2.63 derived above and designated as "adjusted" and "unadjusted" respectively. As these estimates indicate, the income generated is about 54 percent higher with the unadjusted compared with the adjusted multiplier. Such a disparity in the estimates suggests the extent to which resources may be over-allocated to the tourist industry when policy decisions are guided by the inflated multiplier. As earlier investigation in this chapter indicates, any such misallocation of resources can be prevented or corrected by employing the SMP framework. Public policy issues based on that framework will be the focus of the next chapter.

TABLE VII-7

TOURIST MULTIPLIERS AND INCOME GENERATION,  
THE JAMAICAN ECONOMY, 1960-1980.

| Year | Tourist<br>Expenditures | Estimated Income Generated <sup>a</sup> With               |                                       |
|------|-------------------------|------------------------------------------------------------|---------------------------------------|
|      |                         | Adjusted <sup>b</sup><br>Multiplier<br>(U. S. \$ millions) | Unadjusted <sup>b</sup><br>Multiplier |
| 1960 | 40.3                    | 68.9                                                       | 106.0                                 |
| 1961 | 40.9                    | 69.9                                                       | 107.6                                 |
| 1962 | 36.7                    | 62.8                                                       | 96.5                                  |
| 1963 | 37.8                    | 64.6                                                       | 99.4                                  |
| 1964 | 43.7                    | 74.7                                                       | 114.9                                 |
| 1965 | 65.0                    | 111.2                                                      | 170.9                                 |
| 1966 | 78.4                    | 134.1                                                      | 206.2                                 |
| 1967 | 79.8                    | 136.5                                                      | 209.9                                 |
| 1968 | 87.8                    | 150.1                                                      | 230.9                                 |
| 1969 | 93.5                    | 159.9                                                      | 245.9                                 |
| 1970 | 98.6                    | 168.6                                                      | 259.3                                 |
| 1971 | 116.3                   | 198.9                                                      | 305.9                                 |
| 1972 | 138.2                   | 236.3                                                      | 363.5                                 |
| 1973 | 148.3                   | 253.6                                                      | 390.0                                 |
| 1974 | 155.3                   | 265.6                                                      | 408.4                                 |
| 1975 | 149.7                   | 256.0                                                      | 393.7                                 |
| 1976 | 123.2                   | 210.7                                                      | 324.0                                 |
| 1977 | 104.5                   | 178.7                                                      | 274.8                                 |
| 1978 | 148.2                   | 253.4                                                      | 389.8                                 |
| 1979 | 194.3                   | 332.3                                                      | 511.0                                 |
| 1980 | 186.5                   | 318.9                                                      | 490.5                                 |

Source: Tourist expenditures are taken from Table VI-4.

Notes: <sup>a</sup>Estimated income generated is the product of tourist expenditures and the multiplier. It should be noted that the multiplier process may not necessarily work itself out within the same year the expenditures are made. Thus although income generated is associated with a particular year's expenditures, that income may not all be generated within that same year.

<sup>b</sup>See text.

## CHAPTER VII

## NOTES

1. H. Peter Gray, op. cit., p. 140.
2. See Raul Prebisch, "Commercial Policy in the Underdeveloped Countries," American Economic Review, May 1959, pp. 251-273.
3. Prebisch's analysis apparently assumes a fixed exchange rate, for a flexible exchange rate system could cause some possible reversal of the above-indicated trend towards adverse terms of trade. This might come about, for instance, because of a depreciation of the currency of the advanced country vis a vis the developing country's currency which would not appreciate. Since depreciation worsens the terms of trade while appreciation improves them, such a change in the exchange rate could therefore change the terms of trade in favor of the developing country. For a detailed discussion of these issues, see Charles P. Kindleberger, International Economics, Fourth Edition, Richard D. Irwin, Inc., Homewood, Illinois, 1968, pp. 265-269.
4. See for example, M. J. Flanders, "Prebisch on Protectionism: An Evaluation," Economic Journal, June 1964, pp. 306-326, Reprinted in W. L. Johnson and D. R. Kamerschen (editors) Readings in Economic Development, Southwestern Publishing Co., Cincinnati, 1972, pp. 409-430; and Jacob Viner, "The Economics of Development" in A. N. Agarwala and S. P. Singh, The Economics of Underdevelopment, Oxford University Press, 1963, pp. 25-59.
5. See evidence on elasticity earlier in this study.
6. Cf. M. E. Bond and Jerry Ladman, "Tourism: A strategy for Development," in Charles E. Gearing, William W. Swart, and Turgut Var, Planning for Tourism Development, Praeger Publishers, New York, 1976, pp. 46-60.
7. H. Peter Gray, op. cit., p. 134.
8. Ibid., pp. 134-135.
9. These are in the form of migrant remittances and gifts.
10. National Planning Agency, Economic and Social Survey of Jamaica, Government Printery, Kingston Jamaica, Various Issues.
11. The Jamaican experience testifies to this pattern of deficits. See Ibid.
12. Ibid., (1968 issue) p. 20.
13. See United Nations, Element of Tourism Policy in Developing Countries, New York 1973, p. 8.
14. See Economic and Social Survey of Jamaica 1973, p. 74.



15. See critique of multiplier analyses later in this chapter.
16. This rate has averaged 21.8 percent over the last six years. See Economic and Social Survey of Jamaica (Various Issues).
17. The recent declining trend in employment can be attributed to the decline in traffic volume reported earlier in this study, and the corresponding fall in the occupancy rates of hotels.
18. Cf. M. E. Bond and Jerry R. Ladman, op. cit., p. 53.
19. Ibid.
20. See United Nations, Elements of Tourism Policy in Developing Countries, New York, 1973, pp. 23-24.
21. Ibid.
22. John M. Bryden, Tourism and Development, Cambridge University Press, 1973, pp. 73 and 132.
23. See for example H. Peter Gray, op. cit., p. 149; John Bryden and Mike Faber, "Multiplying the Tourist Multiplier," in Social and Economic Studies, Volume 20, No. 1, 1971, and Kari Levitt and Igbal Gulati, "Income Effect of Tourist Spending: Mystification Multiplied: A Critical Comment on the Zinder Report," in Social and Economic Studies, Volume 19, No. 3, 1970, pp. 332-333.
24. H. Zinder and Associates, op. cit., pp. 35-46.
25. Cf. Kari Levitt and Igbal Gulati, op. cit., p. 329.
26. Cf. John Bryden and Mike Faber, op. cit., p. 68.
27. See for example, V.K.R.V. Rao, "Investment, Income and the Multiplier in an Underdeveloped Economy," in A. N. Agarwala and S. P. Singh (editors), The Economics of Underdevelopment, Oxford University Press, 1958, pp. 205-218, and H. Peter Gray, op. cit., pp. 149-150.
28. See A. B. Atkinson, The Economics of Inequality, Oxford University Press, London, 1975, p. 248.
29. There is some evidence to indicate that this is the case in the Caribbean. One study showed that approximately 64 percent of hotel employees were either unskilled or semi-skilled. See John M. Bryden, Tourism and Development, Cambridge University Press, 1973, p. 128.
30. This does not preclude the inflation possibility referred to above.
31. This concept was initially developed by Alfred E. Kahn, "Investment Criteria In Development Programs," Quarterly Journal of Economics, February 1951, pp. 33-61, and applied by Hollis B. Chenery, "The Application of Investment Criteria," Quarterly Journal of Economics, February 1953, pp. 76-96.
32. Cf. H. Peter Gray, op. cit., pp. 141-152.

33. It is recognized that externalities also exist in advanced economies so that maximum welfare is not achieved despite such allocation of resources.
34. R. N. Tripathy, "Criteria for the Selection of Investment Projects," in Economic Development-Challenge and Promise, Edited by Stephen Spiegelglas and Charles J. Welsh, Prentice Hall, 1970, p. 65.
35. Hollis B. Chenery, op. cit., p. 83.
36. H. Peter Gray, op. cit., p. 141.
37. Ibid., p. 141.
38. This term should be divided by  $K = K_i + K_d$  to get the balance of payments premium per unit of investment.
39. It will however be argued later that foreign investment may not be necessarily good for the host country.
40. Construction equipment and materials as well as the furnishing of high-rise luxury hotels are major contributors to this capital intensity. See Chapter VI also.
41. In developing economies like that of Jamaica, there tends to be consistent deficits in the current account. This is largely explained by the fact that primary products which constitute their major exports are subject to the built-in rigidities of the international agreements through which they are marketed, while capital and other manufactured goods are imported at prices which are always increasing. See The Government of Jamaica, Economic Survey, Jamaica, 1968, The Government Printer, Kingston, Jamaica, 1969, p. 20. This argument is also a variant of Prebisch's thesis. See Raul Prebisch, "Commercial Policy in the Underdeveloped Countries," American Economic Review, May 1959, pp. 251-273.
42. See National Planning Agency, Economic and Social Survey of Jamaica, Government Printer, Kingston, Jamaica, (Various Issues).
43. For some of the issues involved in this choice, see for instance William J. Baumol, "On the Discount Rate for Public Projects" in Public Expenditures and Policy Analysis, edited by Robert H. Haveman and Julius Margolis, Arnold Harberger, "On Discount Rates for Cost-Benefit Analysis" in Readings in Economic Development, edited by Walter L. Johnson and David R. Kamen-schen, South-Western Publishing Company, Cincinnati, Ohio, 1972, pp. 181-198.
44. During the construction phase of the project, a part of the investment might contribute to a deficit in the balance of payments depending on whether the investment resources cause a drain on the country's foreign exchange. If this is the case, then the appropriate value of the premium on the balance of payments effect to be employed should be that value of  $r$  which will prevail when returns from the completed project have begun to be realized. The further into the future these returns are deferred, the higher will be the value of the premium  $r$ . Cf. Hollis B. Chenery, op. cit., p. 94, and H. Peter Gray, op. cit., p. 152.

45. Hollis B. Chenery, op. cit., p. 94.
46. This was the same size project assumed by Bryden in his application of social cost-benefit analysis to tourism in the Caribbean. See John Bryden, op. cit.
47. Ideally, the anticipated prices over a period of years should be used instead of the "current" prices used in these estimates.
48. This was the average occupancy rate of hotels in Jamaica over the years (1969-1980). See National Planning Agency, op. cit.
49. This includes lodging, food, and miscellaneous expenditures at 1975 prices.
50. It is recognized that there are other determinants of tourist expenditures than the hotel per se. However, it is assumed that these expenditures are contingent upon the availability of accommodation in this hotel, ceteris paribus. That is, if the hotel were not built, these visitors and their expenditures would have gone elsewhere.
51. This is the estimated percentage of tourist expenditures that leave Jamaica through the various forms of leakages. See National Planning Agency, op. cit., p. 74.
52. It is recognized that the inclusion of only labor cost will have the effect of understating C and overstating the SMP. Ideally an allowance should be made for rent payment to the land used, if such land has a greater than zero opportunity cost. However, it will be argued later that such rent accrues to foreign owners and is therefore included in  $M_1$ .
53. This value was derived by first taking 25 percent of the total tourist expenditures (receipts), then 75 percent of that figure. These percentages are based on estimates that wages and salaries take about 25 percent of tourist expenditures in the Caribbean, and that about 25% of such wages and salaries are received by expatriates (i.e., 75 percent received by nationals). The real cost of wages and salaries to expatriates is already included in foreign exchange loss estimated by  $M_1$  above. For the percentage estimates employed here, see Zinder, op. cit., p. 42 and John M. Bryden, op. cit., pp. 125 and 179.
54. This is an assumption made for purposes of this study. It is more conservative than Bryden's shadow wage rate of 74 percent (also an assumption -see John M. Bryden, op. cit., p. 176). The lower rate assumed here seem plausible because of some evidence (Bryden Chapter 2) that the workers in Caribbean tourism come primarily from agriculture where limited arable land and relatively large farm families suggest a "low" marginal product of labor. That is, the marginal product of the worker in tourism is likely to be quite low in his alternative occupation (agriculture) and similarly the (market) wages workers receive in tourism are likely to be well above the social opportunity cost of labor thus employed.

The computation of a shadow wage rate would necessitate the use of various assumptions, the estimation of several variables, and some present value discounting. The framework within which this can be done and some related problems are discussed elsewhere. (See for example John M. Bryden, op. cit.,

- pp. 86-88 and 175-177). Such an estimate for Jamaica will not be attempted by this study, for only an aberrant result is anticipated from the use of the available data. Instead the earlier assumption with respect to the shadow wage rate is employed. It should be noted from the SMP equation that ceteris paribus, the lower the shadow wage the larger will be the value margin and the SMP of investment.
55. See John M. Bryden, op. cit., Chapters 7, 8 and p. 177.
  56. These figures are based on the assumption that foreign capital accounts for 75 percent and domestic capital accounts for 25 percent of the \$2,535,000 investment. cf. Ibid., p. 179-180.
  57. The premium on foreign exchange can be calculated based on the "black" or "free" rates, taking into account the amounts to be converted both at these rates and the official rate of exchange. That is, by assigning some weight to the amounts exchanged at say the black rate and at the official rate, there would be some indication of the extent to which the shadow price differs from the market price of foreign exchange. For instance, if the official rate is 4 and the black rate is 8, and conversion at the official rate is three times as large as that at the black rate, an average of 5 (i.e.,  $\frac{3 \times 4 + 1 \times 8}{4} = 5$ ) would be a "reasonable shadow price.  
4  
This price of 5 relative to the market price of 4 suggests that the domestic currency is 25 percent overvalued. Cf. Jan Tinbergen, Development Planning, McGraw-Hill Book Company, New York, 1967, p. 157.
  58. In developing economies like Jamaica's, depreciation of the domestic currency or import restrictions to correct their balance of payments position may not be desirable options because of the potential negative impact on GNP. That is, these economies are characterized by very low elasticities of both supply for exports and demand for imports in the short run; a large percentage of their imports being raw materials and other producer goods. These imports (raw materials) usually undergo processing whose value is several times that of the imports. Therefore policy that reduces such imports would in turn reduce GNP by the amount of processing that would be eliminated. Cf. Hollis B. Chenery op. cit., pp. 81-85.
  59. Note that these are in terms of current prices instead of anticipated prices over the life of the project. Furthermore, inasmuch as these returns are to be received in the future, they should be discounted to their present value. That was not attempted here for reasons indicated earlier regarding the choice of the "correct" discount rate and related problems.
  60. Such investment must be estimated to lead to equilibrium in the balance of payments over a specified period of time; Hollis B. Chenery, op. cit., p. 81.
  61. Ibid., p. 78.
  62. Presumably, some sort of economies of scale is achieved by concentrating hotels in particular areas of the country. That is, as more hotels are built in an area the related infrastructural investment will increase less than proportionately; two hotels in the same area would not require twice as much infrastructure as one. Thus the ratio of domestic to foreign investment will tend to fall as more hotels are built.

63. National Planning Agency, Economic and Social Survey of Jamaica, 1976, The Government Printer, Kingston, Jamaica, 1976, p. 147.
64. National Planning Agency, Economic and Social Survey of Jamaica, 1981, p. 15.2. In 1981 National Hotels and Properties Limited also embarked on its divestment program "which offered for lease or sale eight of thirteen properties in which the Government had majority interest and which were being operated by the company." Offer for lease or sale was made to the private sector. Ibid.
65. This discussion has benefited substantially from Kari Levitt and Igbal Gulati, op. cit.
66. The marginal import coefficient is distinguished from the marginal propensity to import in that the former recognizes that investment like consumption also has an import content, while the latter implies that only consumption has an import content; Cf. Charles Kennedy, "Keynesian Theory in an Open Economy," in Social and Economic Studies, Volume 15, No. 1, 1966, pp. 1-21.
67. The amount that local factors receive can be estimated as follows:
 

Foreign currency inflows

less

Capital repayments, and remitted profits of foreign enterprise

less

Payments for imported inputs (materials, salaries for expatriate personnel, sales and marketing costs)

equal

Payments for local factors of production plus taxes.
68. The value for  $m_i$  is the same estimate used earlier in this chapter; for source see section on application of the SMP framework. The estimate of  $m_d$  was derived by taking the ratio of the annual changes in imports to the annual changes in gross national product over the period 1971-1981. Similarly, the estimate of  $c$  was derived by comparing total consumption expenditure to gross national product over the same period. Data were obtained from National Planning Agency, Economic and Social Survey of Jamaica, Various Annual Editions.



PART III

POLICY IMPLICATIONS



Having examined a framework for determining the economic impact of tourism, it is appropriate to investigate the use of that framework as a guide to public policy. Thus using that framework which was developed in Part II (Chapter VII), this part of the study will investigate the measures that public policy may take in order to achieve the result which is presumed to be policy's objective. It is in the light of this objective, that the public policy alternatives with respect to the projected tourism growth trend will be examined. First a detailed investigation of the relevant policy issues is undertaken; then a summary of these issues is provided at the end of this section of the study.

## CHAPTER VIII

### SOME POLICY ISSUES

By comparing the social marginal productivity in tourism with that of investment in other projects, the appropriate amount of priority can be determined with respect to the allocation of scarce domestic resources to tourism. Assuming that tourism does qualify for such resources, then public policy will presumably seek to maximize the SMP of investment in tourism. In its attempt to increase the SMP of investment in tourism, Jamaican public policy should put particular emphasis on maximizing the value margin, for this is the value added to net national product by the investment. Also, as indicated earlier, relatively little policy emphasis needs be put on the capital intensity (or rate of capital turnover) since foreign capital<sup>1</sup> constitutes the bulk of investment in Jamaican tourism, so that capital intensity measured in terms of domestic capital is relatively low. Furthermore, in attempting to increase the value margin public policy may at the same time lower the capital intensity or raise the rate of capital turnover. That is increasing the magnitude of the variable  $V_i$  in the SMP equation is one of the measures that public policy might undertake to increase the value margin, and an increase in  $V_i$  will ceteris paribus lower the capital intensity or raise the rate of turnover of investment.

#### Increasing the Value Margin

As indicated above, one alternative is to try and increase the volume of international tourists on the assumption that this will increase tourist expenditures or receipts from tourists ( $V_i$ ); but this could give rise to some other problems which are discussed below. Policy aimed at increasing tourist volume often include more

aggressive advertising and promotional activities. However, this would be self-defeating in terms of trying to increase the value margin, if any resulting increase in  $V_i$  is more than offset by the related increase in  $M_i$  the foreign exchange leakage involved in promotional expenditures abroad.

Policy might also attempt to increase tourist volume and  $V_i$  through control of the prices of tourist goods and services. It will be recalled from the earlier discussion that low prices in the host country might help to offset the negative impact of rising airline cost and air fares on traffic growth. That is, given the complementarity of destination costs (i.e., for goods and services) and air transport cost (air fare) in the consumption of a vacation, the growth of air traffic will be influenced by the cross-elasticity of demand for air transportation with respect to the price of the goods and services in the host country.

Some price control can be achieved through fiscal policy, for instance through the lowering or removal of excise taxes or other duties. Where such tax relief is applied to luxury items, the policy would tend to make the overall tax structure regressive. The situation would be exacerbated where such luxuries have a high import content, thereby contributing to a loss of foreign exchange while at the same time reducing government revenue from the taxing of these items. Furthermore, any such taxing and pricing policies would be of only limited effectiveness in increasing tourist volume and tourist expenditures in a particular country, since this effectiveness would be reduced by competing tourist exporting countries adopting similar policies.

Other things equal, the larger the volume of tourists the larger the receipts from tourism, and hence the larger will be  $V_i$ . However, as indicated above, certain problems might arise from increasing tourist volume or tourist density, in that this increase may lead to a fall in  $V_i$ . This argument is based on some evidence<sup>2</sup> that in the Caribbean, tourist density (measured by the ratio of tourist arrivals to

domestic population) is positively correlated with the degree of unfriendliness of natives towards foreign visitors. Thus policy aimed at increasing tourist receipts ( $V_i$ ) via increasing tourist arrivals would also have the effect of intensifying hostility towards tourists.

As the degree of unfriendliness increases, it will tend to impair the quality of the host country's tourism export, thereby shifting the demand curve downwards and lowering the price.<sup>3</sup> In consequence, the total receipts from tourism would fall in the "long run." Thus in terms of the SMP equation, an increase in tourism could ultimately give rise to a decrease in  $V_i$  thereby lowering the value margin.

In addition to the problem of hostility towards tourists, public policy must also concern itself with another possible source of impairment of the quality of tourism. This is the deterioration in the quality of nonreproducible resources which may result for instance from pollution of the waters and beaches. Such impairment will reduce the rent that these resources can earn as well as the payments to cooperating factors of production.

Countries like Jamaica which are exporters of tourism based on climate, beaches and recreation (as opposed to tourism based for instance on historic sites or culture) are particularly vulnerable to the negative impact of the quality impairment of their tourism. That is, the tourist exports of these countries are good substitutes for each other, and therefore the demand for such exports will not only be price elastic but will also be sensitive to changes in the quality of "service." Given the substitutability among competing exporters and the accompanying demand elasticity, the individual country's receipts from international tourism will be largely determined by market forces. Thus the ability of domestic policy to influence the value margin by controlling  $V_i$  will be restricted by these market forces.

Public policy should explore the possibility of increasing  $V_i$  without increasing tourist density. This can be achieved by exploiting the rent which may accrue to

peculiar features (natural or man-made) of the host country.<sup>4</sup> For instance, tourists who are primarily sun and fun seekers might be lured on tours of historical sites, unique geological formations and so forth, thereby increasing tourist expenditures and hence the receipts ( $V_i$ ) from tourism. Unlike the primary attractions (climate, beaches, etc.) which are highly substitutable among competing tourist exporters, these unique features are "differentiated" and less vulnerable to competition from other attractions. This affords the host country more discretion in the pricing of these attractions. The absence of good substitutes for unique attractions also means that the demand for them is not very sensitive to price changes, so that the total revenue (tourist receipts) from them will increase with increases in the price (charge) to "see" them. Thus ceteris paribus, the value margin will be enhanced by the host country's exploitation of these unique features in addition, or as a supplement to that country's main (i.e., tourist resort) attraction.

Another public policy alternative to influencing the value margin is the control of the import content of that country's tourism. This involves the  $M_i$  variable in the SMP equation. The high import content<sup>5</sup> of Caribbean tourism suggests that reduction in import leakages should be a matter of major concern in policy's effort to increase the value margin.

A prime contributor to these leakages is investment incentives and other concessions<sup>6</sup> applied to various aspects of the tourist industry. These incentives are in most instances motivated by competition among tourist exporting countries in their attempt to attract foreign capital. A relevant question is whether these incentives really attract foreign investment. To the extent that foreign capital would have been forthcoming even in the absence of these incentives, they (the incentives) constitutes a cost to the host government.

Any cost incurred in the use of foreign capital is represented in the value margin by imports ( $M_i$ ). Repatriated tax-free<sup>7</sup> profits, and the spending or saving

abroad of wages earned by imported labor<sup>8</sup> used in cooperation with foreign capital are important components of this cost. Foreign investment typically gives rise to foreign ownership of the non-reproducible tourist resources (land, beaches) of the host country. This means that the rent accruing to the owners of those resources goes to foreigners instead of to nationals. This situation is exacerbated when such rent (disguised as profits) is taken out of the country.

The repatriation of profits by foreign investors, and of savings by foreign workers in the tourist industry are tantamount to imports by the host country; and as such they contribute to a reduction in the value margin. A further implication<sup>9</sup> of these remittances overseas is that they reduce potential "domestic" savings and thus tend to perpetuate dependence on foreign capital, since such savings are not re-invested locally. Continued reliance on foreign capital necessitates continued and even more generous incentives to foreign investors, given the competition for foreign capital among tourist exporting countries. This is a potentially vicious spiral in which "imports" get progressively larger and the value margin gets progressively smaller.

Paradoxically, the import leakages which public policy should seek to plug are largely of its own making as suggested above. Future policies aimed at reducing imports and increasing the value margin should lessen or remove the incentives now granted to foreign investors. Such policies would restrict the remittance overseas of factor returns earned in the host country. For instance, where the non-reproducible resources are foreign owned, the government of the host country can capture the rent earned by these resources through the imposition of a tax on hotel revenues (room charges) where such revenues are assumed to reflect economic rent. Alternatively, the rent can be retained in the host country by leasing rather than selling these resources to foreign investors, so that these resources revert to the host government after a specified number of years.<sup>10</sup> The repatriation of the



personal savings of expatriates can be reduced or eliminated by the training of nationals to fill the skilled and professional positions in the tourist industry. Additionally, leakages can be reduced by the imposition or elevation of import duties on tourist consumption items, and by the development and promotion of local products.

The reduction of incentives in the form of the more stringent import policies indicated above, would tend to curtail foreign investment in Jamaica especially if the competing tourist exporting islands of the Caribbean maintain more generous incentive policies. If a lack of foreign investment results in a scarcity of tourist capacity (accommodation and other facilities) in Jamaica, this would tend to inhibit the growth of tourism in this island. However, a lower rate of growth of tourism may not be inconsistent with, and may even promote the goals of public policy. That is, a lower rate of tourism growth may enhance the value margin by increasing  $V_i$  as explained below.

The scarcity of tourist facilities that would result from the lack of foreign investment would cause the price of the available capacity to rise. The higher price of facilities in Jamaica would repel some potential tourists who would seek a substitute vacation in one of the competing Caribbean islands or elsewhere where prices are lower. This would tend to lower the tourism density in Jamaica relative to that of the competing tourist exporting islands. As indicated earlier, the higher tourism density in the other islands would tend to impair the quality and shift the demand curve for their tourism downwards. Analogously, the lower tourism density in Jamaica would "improve" the quality of its tourism relative to that of its competitors and thus shift the demand curve upwards.<sup>11</sup> With unchanged supply, an upward shift of the demand curve would raise the total receipts ( $V_i$ ) from tourism. This increase in  $V_i$  together with the decrease in  $M_i$  associated with the reduction in foreign investment (see above) would cause the value margin to rise.

### Public Policy Alternatives Relative to Projected Tourism Growth

Earlier in this study a forecast was made of the growth of tourism to Jamaica. Given the predicted downward trend, the question arises as to what public policy can do to affect this trend. One alternative would be to aim at offsetting the trend through such measures as increased fiscal incentives and more vigorous promotion. However as indicated earlier, such policy would produce problems associated with increased tourism density and foreign exchange leakage. Further, the strong negative impact of air transport cost on traffic growth (discussed earlier) suggests that domestic policy will be of limited effectiveness in offsetting that trend.

Another alternative would be to encourage the trend; that is, measures would be taken to reduce the growth rate. Fiscal policies affecting the investor-supplier of tourist facilities as well as the tourist-consumer can be used to help achieve this result. For instance, as indicated above, the reduction or removal of tax and other incentives to foreign investors would have the effect of restricting the growth of these facilities in Jamaica if more generous incentives are available in neighboring islands or other resort areas. Excise taxes on tourist commodities and services will have the effect of increasing the prices that tourists pay, thereby reducing the quantity of these goods and services demanded. At the same time, the availability of substitute resorts in competing tourist countries where prices are lower will cause the demand for Jamaican tourism to fall.<sup>12</sup> Arrival and departure taxes imposed on travelers could also be manipulated to have the desired negative impact on demand.

Policies aimed at restricting the growth of tourism are likely to be more effective than those aimed at promoting growth. In the case of growth restriction these policies will directly or indirectly raise prices to tourists. Also the reduction or removal of incentives, or the introduction of disincentives (example imposition

of taxes) will reduce profits or generate losses to the producer (investor) of tourist goods and services. These taxes could be elevated to whatever level is necessary to make competitive (substitute) tourist exporting countries more attractive to both investors and consumers. The taxes on producers (investors) would shift the supply curve of tourist facilities upwards (leftwards), and the availability of lower-priced substitutes (at other resorts) would shift the demand curve downwards (leftwards) so that the quantity exchanged per unit of time will decrease. What happens to the equilibrium price will depend on the relative shifts of the two curves. Public policy can through the appropriate level of taxation influence the amount of shifting of these curves so that the equilibrium price increases with a decrease in quantity. In effect, policy will determine the total receipts ( $V_t$ ) from tourism.

In the case of tourism growth promotion, public policy could analogously try to make Jamaica more attractive to both the tourist-consumer and the investor-producer by tax reduction or removal, or by subsidy. However, in order to achieve the desired rate of growth, the government might have to keep on incurring larger and larger cost of such subsidy. In addition, there will be increased import cost in the form of more vigorous promotion abroad. Unless the objective is to maximize tourism growth per se, such policies would be very costly to the government and would benefit non-nationals rather than nationals. Further, policy's attempt to promote the growth of tourism through such incentives is likely to be frustrated by the adoption of similar incentives by competing tourism exporting countries.

Whether the alternative of promoting tourism growth or that of inhibiting it is pursued, the objective of public policy should presumably be the maximization of the net returns from tourism to the nationals of the host country. As the foregoing arguments suggest, this objective is not necessarily achieved by promoting tourism growth which is the policy espoused by Jamaica and most tourism exporting countries. Restricting the growth of tourism is an alternative which these countries should explore.

### Summary of Policy Issues

Assuming that on the basis of its social margin productivity tourism ranks high on the list of investment priorities for Jamaica, public policy should seek to maximize the value margin of tourism which is the value added to net national product by investment in tourism. This can be achieved in two ways—namely (1) increasing international tourist expenditures in Jamaica or Jamaica's receipts from tourism and (2) reducing the import leakages associated with Jamaican tourism.

Ideally these two policy measures should be concomitant and cooperating in augmenting the value margin, but in practice they are sometimes conflicting. That is, steps taken to increase the receipts from international tourism often conflict with those intended to reduce import leakages. For example, expensive overseas advertisement and promotion intended to lure tourists to Jamaica and hence increase tourist expenditures there will also result in a drain of foreign exchange for those promotional activities.

Increasing the receipts from international tourism can be achieved through policies designed to increase the volume of international tourists and their corresponding expenditures. Such policies include: (a) more aggressive and effective advertising and promotional activities, (b) some safeguard against escalating domestic prices that tend to drive away visitors, (c) exploiting the rent which may accrue to secondary tourist attractions such as peculiar natural or man-made features in a country whose primary tourist attraction is climate.

Import leakages can be reduced through: (a) less liberal investment incentives and other concessions to foreigners including the restriction of the repatriation of profits and wages earned by them in the host country, (b) the training of nationals to replace foreigners who hold skilled and professional positions in the tourist industry, (c) the development and promotion of local products to supplant imported tourist consumption items and (d) the imposition or elevation of import duties on tourist consumption goods.

Relative to the projected downward trend in the growth of tourism to Jamaica, public policy can attempt to offset this trend through such measures as increased fiscal incentives (tax reduction or removal, or subsidy) and more vigorous promotional activity. However, while such policies might promote the growth of tourism per se, they will not necessarily enhance the value margin because of the costs (foreign exchange, impairment of tourist resources and the quality of tourism) associated with them.

Another public policy alternative would be to adopt measures that encourage the downward trend in the growth of tourism. For instance, incentives and concessions could be reduced or removed, taxes of various kinds increased or imposed, and promotional activity reduced. Despite the reduction in the volume of tourists that would result from these policy measures, the cost saving (foreign exchange, tourism quality restoration or improvement) associated with them would be offsetting, so that a reduction in the value margin need not result. In fact the value margin could be enhanced by the saving of foreign exchange coupled with an improvement in the quality of tourism that maintains tourist receipts at a relatively high level despite a smaller volume of tourists. This is a policy alternative that deserves attention by the policy-makers.

## CHAPTER VIII

## NOTES

1. In a later discussion it will be argued that foreign investment in tourism is not necessarily advantageous to the economy of the host country.
2. John Bryden and Make Faber, op. cit.
3. Cf. H. Peter Gray, "Towards an Economic Analysis of Tourism Policy," in Social and Economic Studies, Volume 23, No. 3, September 1974.
4. H. Peter Gray, op. cit. (International Travel-International Trade), p. 155.
5. See earlier evidence with respect to Jamaica.
6. For details of Caribbean incentives see F. M. Andic, "Fiscal Incentives: A Brief Survey," in Social and Economic Studies, Volume 17, No. 1, March 1968.
7. Tax holidays of up to 15 years are granted under the Jamaica Hotel Incentives Act of 1968. See Financial Post, Magazine Section, November 1969, p. 2.
8. There is some evidence to indicate that a relatively large share of the earnings in Caribbean tourism accrues to expatriates. For instance, in 1971 non-nationals accounted for about 30 percent of the hotel workers in the Cayman Islands, but these expatriates received about 43 percent of the total wage and salary bill of the hotels. See John M. Bryden, op. cit., pp. 129-130.
9. Cf. Ibid., p. 31.
10. Cf. H. Peter Gray, op. cit., p. 394.
11. This would have some offsetting effect on any downward shift of the demand curve that may be caused from the availability of lower-priced substitutes.
12. As indicated earlier, there would be some offsetting increase in demand due to the relative quality improvement that would result from the lower tourism density. However, if needs be, this increase could be checked by further price increases.



## CHAPTER IX

### SUMMARY AND CONCLUSIONS

Air transport technology has had a major impact on the growth of air traffic and consequently on both the magnitude and character of international tourism. In consequence, some tourist-host countries like Jamaica have experienced major restructuring of their tourist industry and have come to rely on this industry for major contributions to the national economy. These circumstances in turn raise important questions regarding public policy support and the objective function which such policy presumably seeks to maximize.

With the introduction of jet technology into the air transport industry came some important changes in aircraft productivity measured in terms of tonne-kilometres available per hour (TKA/Hr.). The rise in productivity associated with jet technology is attributed to changes in such aircraft characteristics as average payload capacity, speed, utilization rates and range. The average size or payload capacity of aircraft measured in tonnes increased constantly over the years, and by 1980 was 22.3 tonnes or approximately 3.6 times larger than it was when jets were first introduced into service in 1958. This was the largest increase in any of the dimensions of aircraft productivity investigated by this study. Stage distance similarly increased steadily to reach an average of 823 kilometres in 1980 which was 88.76 percent longer than the average distance in 1958. Between 1958 and 1980, the average block speed for the industry increased by 75.71 percent from approximately 350 to 615 kilometres per hour, while the utilization rate of aircraft increased 51.21 percent from an average of 4.1 to 6.2 hours per day.

Increases in these technological features of aircraft (particularly payload capacity and speed) translate into increases in the volume of output per aircraft

and per unit of time. Given the size (payload capacity) of an aircraft, the higher the speed the more output (tonne-kilometres available) it can generate per unit of time. Similarly, for a given speed, the larger the size of aircraft the larger will be the output per unit of time. It follows, therefore, that as aircraft became larger and faster, productivity (TKA/Hr.) will tend to rise. Such has been the experience of the air transport industry with the use of jet technology.

Over the seven pre-jet years ending in 1957, industry productivity increased by 43.7 percent. With the introduction of jet aircraft into service in 1958, productivity rapidly increased such that over the next five years (1958-1963) its rate more than doubled (106.5% increase). By 1980 productivity was about six times (586.8%) as large as it was when jet aircraft were first introduced into service.

Despite these productivity gains, the evidence indicates that the relative increases were slower in the most recent years of the period investigated. When comparisons were made on the basis of the three decades involved, it was seen that between 1950 and 1959 productivity increased by 78.8 percent. However if the two years (1958 and 1959) of jet operation were excluded, that productivity increase would have been only 43.7 percent. Over the decade of the "sixties" (1960-1969) productivity increased by 133.5 percent, but for the period 1970-1979 the increase was only 58.8 percent.

As these data indicate, the decade of the "sixties" experienced the most rapid rate of growth of air transport productivity, a result attributed to the increasing momentum during that period of the so-called "jet revolution." They also indicate that the decade of the "seventies" was one of declining growth in productivity and therefore suggest that the jet revolution has been losing its momentum in more recent years. This study observed that most (57.1%) of the jet aircraft types in commercial service in 1980 first entered into service during the 1960's.

This investigation revealed that the real cost of airline operation exhibited a consistent inverse relationship with the observed productivity changes, while prices

(air fares) continued to be directly related to operating cost. The evidence indicates that with the tapering off of productivity increases in the 1970's, also came a reversal of the earlier downward trend in unit operating cost. The existence of the inverse relationship between productivity and cost was further confirmed by the results of regression analysis in which cost was the dependent variable, and the independent variables were the various dimensions of productivity.

With the deceleration of productivity growth in recent years have also come several other cost-related factors which have contributed to the reversal of the downward trend in the real unit cost of operation which characterized the industry during the decade of the 1960's. Among those factors are the rising cost of aircraft fuel, of pollution control and noise abatement, and of wages and salaries in the industry.

Air transport operating costs have an important determining effect on the level of air fares. Although the relationship between the two is somewhat distorted by the industry's rate-making machinery (IATA), the evidence indicates that there is a direct relationship between the two. The investigation included regression analysis in which the level of air fare was regressed against unit operating cost. The observed direct relationship between air fare and operating cost suggests that as the latter continues its upward trend, fare increases rather than decreases are in the offing.

Some downward rigidity in the level of air fares will also continue to come from the institutional setting in the international airline industry. With its formal fixing of the level of prices, the IATA rate-fixing machinery has exhibited cartel-like characteristics and consequently quasi-monopolistic pricing behavior. In so doing it has tended to promote an artificially elevated rate structure characteristic of a monopolist's effort to maximize profit.

Such a pricing policy has had the effect of protecting some inefficient carriers, and of forestalling industry rationalization under which competitive pressure would eliminate all but the most efficient carriers charging fares that more truly reflect the cost of providing the service. A "rationalized" air transport industry would also require that other artificial restraints such as bilateral entry restrictions be removed from the relevant markets so that particular airlines are not protected from competition. Given the deep entrenchment of the bilateral process, and the related jurisdictional concerns of the countries involved, it is not likely that such artificial market restraints will ever be completely eliminated. Hence air fares will continue to be somewhat higher than would be the case in a more competitive international environment.

Estimates derived by this study indicate that the demand for air transportation to Jamaica is both income- and price-elastic with elasticity coefficients of 2.226 and 1.472 respectively. Therefore higher fare levels induced by the upward movement of operating cost and supported by the industry's institutional pricing influence will have a dampening effect on the growth of international air traffic.

Projections made by this study indicate that this effect will continue to manifest itself into the decade of the 1990's. The projected rate of growth of air traffic to Jamaica was estimated to be 2.32 percent per year to 1986, and 1.37 percent annually to 1991. By contrast, traffic to Jamaica grew at an annual rate of 12.5 percent between 1960 and 1974 which was the period characterized by the most rapid growth of air transport productivity. Since 1974 the growth of traffic has fallen with the declining growth rate of productivity such that its annual rate for the overall period (1960-1981) averaged about 7.9 percent.

The high rates of growth of air traffic indicated above resulted in a change of the character of the Jamaican tourist industry from one catering to short-stay to one catering to primarily long-stay international visitors. This necessitated some major restructuring of the industry involving large investment in tourist accommo-

dation and related infrastructural facilities. For instance, available accommodation (number of beds) increased 78.3 percent between 1960 and 1969, but even it was estimated that twice as much was needed. Consequently, these facilities were doubled over the next five years.

The increased investment in Jamaican tourist facilities since the jet era involved relatively large amounts of capital compared to the investment in those facilities that characterized the era of cruise ship dominance. This suggests an important change in the ratio of inputs (particularly capital and labor) used to provide these facilities, and raises questions about the relatively high capital intensity of the transformed tourist industry; the scarcity of capital in a developing economy like Jamaica's; and the opportunity cost of the capital allocated to the tourist industry.

The assessment of the economic impact of tourism has often been faulty. The frequently used multiplier analysis suffers from a number of limitations which often elude the unscrupulous investigator. As a consequence, the contributions of tourism to the national economy have often been exaggerated. This study offers the social marginal productivity (SMP) framework as being a more appropriate device for analyzing the economic impact of international tourism on host countries like Jamaica. It is a more comprehensive framework than the "partial" multiplier analysis, and as such it permits the analysis of the economic potential of the tourist industry in terms of a number of variables or subcriteria such as capital intensity and balance of payments effects which are of particular concern to developing economies like that of Jamaica.

An application of the SMP framework by this study demonstrated the importance of the balance of payments effect on the SMP which is the average annual increment in national product from the marginal unit of investment. It revealed that the SMP value is quite sensitive to the country's balance of payments position,

and that on the basis of the SMP a case for investment in tourism would be made stronger the more severe the economy's balance of payments problem. Similar applications of the SMP framework would be a useful approach to the setting up of investment priorities and allocating scarce resources to tourism and other industries.

Jamaican public policy has greatly facilitated the change in nature, and the expansion of its tourist industry which jet aircraft technology has brought about. Government support has come through such forms as infrastructural development and the granting of incentives and concessions to private investors. However, the available evidence raises serious doubts about the efficacy of Jamaican public policy that has governed the development of that country's tourist industry. There appears to be no well-defined policy objective nor criteria for allocating scarce resources to that industry other than a desire to keep increasing the number of tourists, presumably on the assumption that any such increase must necessarily be of economic merit to the host country.

There is also an apparent tendency to measure the "benefits" of increased tourism by the regularly reported and proudly quoted gross tourist receipts (expenditures) whose economic impact is often magnified by deficient multiplier analysis which reflects the analyst's predictions, vested interests or even honest errors. Large increases in tourist traffic and hence tourist receipts will be of little value to the host country so long as its tourist industry continues to be characterized by a high import content. Import leakages occur in such forms as goods for direct tourist consumption, and repatriated factor payments including the rent that accrues to that country's non-reproducible resources which are foreign-owned. Moreover, larger gross tourist receipts are not assured by more rapid growth of tourist traffic, for there is some evidence to indicate that such growth may impair the quality of the host country's tourism thereby lowering its price. In consequence, gross tourist receipts may fall despite a larger volume of tourists.



Thus the higher growth rates of tourism do not guarantee that the net benefit received by nationals will be maximized; and this presumably is the objective which public policy should seek. Countries in general, and Jamaica in particular need to be more aware that an increase in international tourism is not necessarily advantageous to their economic well-being, and that preoccupation with the growth of tourism can cause them some costly misallocation of resources. This awareness is particularly relevant in the light of the earlier projected decline in the growth of air traffic to Jamaica.

The apparent preoccupation of Jamaican policymakers with high rates of growth of tourism suggests that policies to promote this growth are likely to continue and be intensified in an attempt to offset the probable continued decline in air traffic. However, such policies are likely to result in larger "import" costs in the form of advertisement and promotional expenditures overseas, and perhaps the granting of more attractive incentives and concessions of various kinds to foreigners who benefit from these policies at the expense of Jamaican nationals.

As earlier analysis in this study indicates, restrictive rather than expansionary growth policies might be more relevant in terms of the presumed public policy objective. Therefore, at a minimum some policy restraint should be exercised until analysis indicates that the resources allocated to the tourist industry cannot be more efficiently utilized elsewhere in the economy. A relevant question has to do with the alternatives available to Jamaica should there be a major retrenchment of the tourist industry. The answer to this question requires a detailed comparative study of current and prospective industries in that country. This can be accomplished within the context of the SMP framework. A more immediate concern should be how Jamaica can cut her costs without losing some of her benefits from tourism. The foregoing investigation of ways to increase tourist receipts and to lower import leakages suggests one answer.

### Review of Conclusions

The main conclusions stated in this chapter are summarized in this section.

With the introduction of jet technology into the air transport industry a major stimulus was provided to the growth of air traffic to Jamaica. This came via productivity increases and the resulting cost and price changes in the industry. The demand for air transportation to Jamaica is price-elastic, hence the implications of these changes for traffic growth. The stimulus indicated above was particularly strong during the 1960's, but has since subsided with the jet revolution and the resulting tapering-off of productivity growth in the 1970's. The growth of air traffic similarly peaked then began on its downward trend in the early 1970's. This trend is projected to continue into the beginning of the decade of the 1990's.

In response to the earlier rapid growth of traffic, Jamaica undertook a major restructuring and expansion of its tourist industry involving investment in accommodation and related infrastructural facilities. In the meantime the tourist industry gained prominence in the Jamaican economy as a contributor to income, employment and foreign exchange.

Jamaican public policy has been enthusiastically supportive of this expansion of the tourist industry. However some of that support seems misguided since it is apparently based on faulty analysis which tends to exaggerate the benefits that the national economy derives from tourism. This study offers social marginal productivity analysis as being a more appropriate device than multiplier analysis which is often used (and abused) for assessing the economic benefits of tourism to the nationals of host countries like Jamaica.

With the projected decline in air traffic to Jamaica, her tourist industry could experience an increasing amount of idle capacity thereby reflecting a costly waste of scarce resources. Conceivably, this problem could reach the stage where another restructuring of the tourist industry is dictated; that is, where feasible

some resources would be withdrawn from the industry thereby resulting in a scaled-down industry of perhaps diminished economic significance. This however would not necessarily be adverse to the Jamaican economy if the decline in tourism serves to prevent any future misallocation of resources to that industry, and helps to channel any resources previously misallocated to the industry into superior uses. This is not only a matter for future policy consideration, but one that currently deserves serious attention.

#### Recommendations for Further Study

This author is interested in seeing this study extended particularly in two areas, and therefore recommends that additional research effort be devoted to them. The first is the demand for air transportation to Jamaica which was analyzed in Chapter III. That analysis needs to be expanded to include more, or all of the variables indicated there. A more comprehensive analysis would help to improve the quality of the forecast of traffic growth, thereby contributing to more effective planning (public and private) of the tourist industry.

The second area of primary interest, and one that seems to warrant prompt attention, is a study of investment priorities using the social marginal productivity framework. This would determine where tourism ranks on the list of alternatives that may be pursued in terms of the objective function that public policy presumably seeks to maximize. In so doing, it would provide an answer to the important question concerning what the optimum level of Jamaican tourism should be, and help to prevent or correct any misallocation of resources to that industry.

## APPENDIX A

### ANOTHER LOOK AT PRODUCTIVITY

This appendix provides an alternative to the assessment of the productivity developments reported in Chapter II of this study. First, it discusses some of the problems associated with productivity measurement in general; then specific limitations with respect to the international air transport industry are addressed. Against that background, estimates of both total and partial factor productivity in air transportation are derived.

#### The Measurement of Productivity

Numerous measures of productivity expressed as the ratio of output to inputs have been employed by different studies, but the ones most frequently used fit into one of two broad categories - namely, partial and total productivity indices or ratios. The partial indices measure for example, output per unit of capital, or output per unit of labor, while the total index measures output per unit of capital and labor combined. In general, these indices can be stated in symbolic form as follows.

Partial productivity indices:

$$\text{a. } R_k = X/K \quad \text{A-1}$$

$$\text{b. } R_n = X/N \quad \text{A-2}$$

Total productivity index:

$$R = X/(aK + bN) \quad \text{A-3}$$

Where R is an index of productivity or productivity ratio; X is output; K and N are capital and labor inputs respectively; and a and b are some appropriate weights.<sup>1</sup>

More specific definition of these variables and weights used in this study will be given below.

The partial measures are useful when the investigation calls for focus on the productivity of particular inputs. However, by comparing output with only one input at a time, such partial indices do not explicitly recognize changes in the other input(s) which might affect the productivity of the input being investigated. For instance, an increase in the productivity of labor as it is often measured may be due to changes in the labor/capital ratio brought about by the substitution of capital for labor.<sup>2</sup> Thus attributing increases in the output/labor ratio to increased efficiency of labor is a possible pitfall which should be recognized; for any such ratio change may to a large extent depend on the quantities of other factor(s) used in cooperation with labor.

It is therefore appropriate to focus on total factor productivity which has alternatively been referred to as the "residual" or as an index of technological change. It provides a measure of overall productive efficiency which is superior to the efficiency measures suggested by partial productivity indices. That is, unlike the partial measures which compare total output with a single input, the measure of total factor productivity relates aggregate output to aggregate inputs.<sup>3</sup>

The two most frequently used measures of total factor productivity are the arithmetic measure and the geometric index attributed to Kendrick<sup>4</sup> and Solow<sup>5</sup> respectively. Kendrick's arithmetic index can be defined as:

$$R = \frac{X_1/X_0}{a (K_1/K_0) + b (N_1/N_0)} \quad \text{A-4}$$

where the subscript 1 refers to the current period and the subscript 0 refers to the base period; the weights  $a$  and  $b$  are factor income shares in the base period; and  $R$ ,  $X$ ,  $K$  and  $N$  are as defined earlier. Solow's geometric measure permits the determination of the relative rate of growth of the productivity index and is based on the Cobb-Douglas production function which is expressed as:

$$X = AK^aN^b \quad \text{A-5}$$

where  $a = 1-b$ . The annual rate of growth of the geometric index of productivity (the scalar  $A$ ) can be obtained by differentiating the production function given in equation A-5 to get:

$$dA/A = dX/X - [a(dK/K) + b(dN/N)] \quad \text{A-6}$$

By computing the annual rate of change in the Kendrick's productivity ratio, his index can be made interchangeable with the Solow's geometric index. That is, an equivalent of the rate of change of the scalar  $A$  can be derived by modifying equation A-4 to get:

$$dA/A = \frac{X_1/X_0}{a(K_1/K_0) + b(N_1/N_0)} - 1 \quad \text{A-7}$$

Thus given the assumptions<sup>6</sup> on which these indices are based, the two measures provided by equations A-6 and A-7 will presumably yield equivalent results.<sup>7</sup>

Although this study has particular interest in aircraft (and by implication capital<sup>8</sup>) productivity, measures of both total and partial productivity will be derived. The discussion and analysis will focus first on total factor productivity for which the geometric index approach described above will be employed. Then some attention will be given to partial factor productivity.

#### Limitations of this Analysis

Before discussing the variables that will be employed in this analysis, the writer wishes to concede that the measurement of productivity derived in this investigation is severely restricted. It is a somewhat abbreviated and rather aggregative approach in which focus is put on the industry as a whole instead of on individual carriers within the airline industry. Further, output is defined in terms of a single product, and the familiar (though often restrictive) dichotomy of inputs into capital and labor is employed.



In more detailed analysis, airline output and input could be broken down into several component parts. For example, output could be subdivided into passenger service (first class and economy class), freight and mail. Input could be broken down into various types of labor (pilots and copilots, other flight personnel, maintenance, administration, etc.); into various types of capital (aircraft, maintenance, equipment, buildings, etc.); and other inputs such as fuel, lighting, heating, passenger meals and so forth. Such breakdown should obviously yield more and presumably superior information, and is particularly useful when indicating sources of growth. For example, a subdivision of airline inputs that isolates fuel as one component is appropriate given the changes in fuel prices in recent years.

While such detailed breakdown is of interest, the present study is more concerned with deriving some indicator of the relative magnitudes of overall productivity changes rather than the sources of productivity growth per se. For this, the aggregative approach adopted here, though imperfect, will suffice. A more detailed procedure demands that study be devoted entirely to airline productivity. The methodology and the related detailed breakdown of variables that such study requires, involves a mammoth computational task even for short time periods and particular markets or airline carriers.<sup>9</sup>

#### Definition of Variables

Whether variables are defined in physical or value terms, a primary concern should be that they are consistently specified. Ideally, the variables should be defined in physical terms since the production function expresses a physical relationship between inputs and outputs. Physical measures presuppose homogeneity of output (as in the case of a single product industry) and of inputs. The assumption of homogeneous inputs is obviously questionable as in the case of labor hours, unless some provision is made to weight the hours contributed by the different categories

of workers. (See further discussion of the labor input below). However, even in the absence of a weighting process, the homogeneity assumption might not be serious provided that a consistent definition of variables is applied; for any changes in the composition of an input or in the input mix will show up in the annual productivity ratios.

### Capital

Questions often arise concerning the capital series to use in empirical analysis. The measurement of capital in physical terms though preferable for production function type investigation, poses the familiar (and sometimes impossible) task of aggregation. That is, with nonhomogeneous capital units it is often not possible to find a satisfactory common denominator for expressing physical capital. In attempting to circumvent the problem of physical measurement of capital researchers often resort to measuring capital in value terms; but here again controversy abounds. The literature<sup>10</sup> is replete with such questions as how the money value of capital stock should be assessed and deflated in order to arrive at some satisfactory constant dollar measure of such capital.

The measurement of capital is further clouded by controversy regarding the use of net versus gross capital and the underlying issue of depreciation. One problem is that reported depreciation tends to be influenced by tax laws, and this in turn tends to cause net capital to be understated and consequently the productivity age, an increase in which does not necessarily cause a reduction or deterioration of the services provided by that equipment. For example, a machine such as an aircraft which gives identical services over its productive life should have the same value each year. In the case of aircraft, depreciation is more related to obsolescence than to use. Thus a jet that is ten years old provides services as good as when it was new;<sup>11</sup> yet obsolescence depreciation will cause its market value to fall with time. Such an accounting procedure would therefore tend to understate capital stock.

Even if there were no problems in assessing depreciation, the use of net capital stock series would still suffer from the limitation that such series measure only the productive facilities available and not the extent to which these facilities are used. Such series therefore tend to underestimate the productivity of capital.<sup>12</sup> The employment of measures of capital utilization would shift the focus from the stock of capital to the flow of capital which should be the more relevant concern in production function investigation.<sup>13</sup>

Turning now specifically to air transportation, attention is called to several measures of capital that have been employed in empirical work. Focussing on the physical measurement of capital, Dhruvarajan and Harris<sup>14</sup> used three measures - namely, number of aircraft, number of aircraft hours flown and number of aircraft ton-hours flown. The first two measures are self-explanatory. The third measure they derived by taking the product of the sum of the gross take-off weight of each aircraft type times the number of hours flown by that aircraft type. They considered this adjustment to aircraft hours flown necessary to account for such differences as the size, speed and range of different aircraft types.

Ellison and Stafford also employed measures of physical capital in their analysis.<sup>15</sup> They used two measures of aircraft stock - namely, aircraft numbers and aircraft capacities. They weighted aircraft numbers by the life expectancy of each aircraft type, using survivor curve information. They considered such adjustment necessary to account for the physical and productive deterioration<sup>16</sup> that occurs with the age of aircraft. For their second measure - aircraft capacities, they weighted each aircraft type by its average productive capacity which is derived by multiplying average block speed by average available payload.<sup>17</sup> Caves, Christensen and Tretheway<sup>18</sup> employed a value measure of capital in their analysis. This measure is total aircraft capital cost which they estimated for each year by taking the product of the estimated lease payments for each aircraft type and the number of aircraft.

Given the controversy about the measurement of capital indicated above, and the fact that no single measure is completely satisfactory, this study employs four physical measures of capital. The hope is that the use of so many measures will provide a check on the consistency of the results of the analysis. These measures are similar to the ones used in the studies referred to above and are defined<sup>19</sup> as follows:

$K_1$  = Aircraft Hours Flown.

$K_2$  = Aircraft Tonne-Hours Flown. For purposes of this study this is defined as the product of aircraft hours flown and average payload capacity<sup>20</sup> measured in tonnes.

$K_3$  = Number of Aircraft.

$K_4$  = Aircraft Capacity, derived as the product of average payload capacity measured in tonnes and average block speed measured in kilometre - hours.

#### Labor

For purposes of this study the labor input (N) is measured by total manhours worked each year in the industry. This measure is somewhat unsatisfactory in that these are hours of total personnel without any adjustment for the different categories of workers that contributed those hours. For instance, the hours worked by pilots and copilots are counted the same as those worked by cabin attendants. The problem would be less serious if all skills categories were changing over time at the same rate so that the ratio of workers (and hours) in the different categories remains constant. This is obviously not the case as exemplified again by the two categories mentioned above; that is, with the advent of larger aircraft the ratio of pilots and copilots to cabin attendants has obviously decreased.

Ideally, some weighting procedure should be employed whereby the hours might be weighted for example by the wage rate of the different categories of

workers. But this introduces another familiar problem - that is the assumption that wage rates received by different workers are a good indication of the relative worth of these workers. Even this imperfect weighting procedure could not be followed here because of the aggregated character of data available for the international airline industry. An alternative would be to examine the annual data for each carrier for thirty years - another infeasible task.

Another related problem is that available reports on the international industry do not provide the number of hours worked by each employee category. Such data would be needed to execute a weighting process. Given the diverse labor market characteristics in the more than one hundred and forty countries whose carriers comprise the international airline industry, it is dangerous to assume that even intra-category all of the industry's workers within that category (such as pilots and copilots) work the same number of hours per day.

Further, the reported data for the international industry do not indicate whether or not any adjustments were made for work stoppage due to worker strikes. If no such adjustments were made, then labor input would be understated for those years in which strikes did occur. There are however some mitigating factors. First, the impact of a strike is likely to be less severe on the international than on a national industry, for in the international case relatively few airlines are likely to have their total operation suspended. Secondly, the reduction in labor input due to strikes will also result in corresponding reduction in the capital input and the output of the industry so that the resulting productivity estimates will be somewhat self-adjusting.

### Output

Although the primary interest of this study is traffic growth and hence the passenger service component of output, the industry's output used in this analysis is measured in tonne-kilometres (instead of seat-kilometres) so as to include freight.

Furthermore, account is taken of the fact that not all of the output produced is sold (the unsold part being non-storable and therefore perishable). Hence two measures of output are employed in this analysis. They are defined as follows:

$X_1$  = Output measured in terms of Tonne-Kilometres Available (TKA).

This is the measure of total output.

$X_2$  = Output measured in terms of Tonne-Kilometres Performed (TKP).

This is the measure of that part of output which is sold, or the revenue output.

The difference between these two measures of output is based on the load factor which represents the occupancy rate of the available capacity. Load factor therefore relates capacity demanded to capacity produced. This distinction is important within the context of productivity investigation for it provides a basis for long-term planning by airline management to try and minimize the disparity between demand and the supply of a perishable output - a disparity which has been characterized by surpluses.

#### Weighting of Variables<sup>21</sup>

The weighting method employed in this analysis involves the use of base year weights. As a means of combining inputs and outputs, the base period weighting procedure has merit if the base period is characterized by economic stability. In such a case, the base period weights (prices) are less likely to represent a situation of short-term disequilibrium where revenues and long-term production costs may easily diverge. Instead these weights can be considered indicative of the long run relative costs of inputs or of producing outputs.

However, where economic stability is not the case, the use of fixed (base year) weights (prices) to combine inputs will cause the movement of the resulting aggregate input index to be distorted. That is, where the relative importance of



inputs changes over time such that their prices do not move together, these shifts will not be reflected by the use of fixed weights.

An alternative to the use of fixed weights is the moving weights or index link method such as is provided by the Divisia index. With this procedure the weights are allowed to shift continuously thereby reducing the distortion in the aggregative index while at the same time preserving the quality of the measurement of the quantity change. To derive the percentage rate of growth in the aggregate index, the percentage rates of growth in the component series are weighted by their current value weights. For example, if A is the aggregate index series and B and C are the component series, then the percentage rate of growth in A is given by:<sup>22</sup>

$$\frac{1}{A} \frac{dA}{dt} = w \frac{1}{B} \frac{dB}{dt} + (1-w) \frac{1}{C} \frac{dC}{dt}$$

where  $w$  and  $(1-w)$  are the current value weights of B and C respectively. If the component series are input series these weights would represent the respective shares of these inputs in total cost. If B and C are output series then  $w$  and  $(1-w)$  would represent the shares of these outputs in total revenue. The Divisia index A can then be calculated by the following equation:<sup>23</sup>

$$\log A_t - \log A_{t-1} = w_t^* [\log B_t - \log B_{t-1}] + (1-w_t)^* [\log C_t - \log C_{t-1}]$$

where  $t$  and  $t-1$  are time periods and the weights are averages of the two time periods; that is:

$$w_t^* = \frac{w_t + w_{t-1}}{2}, \text{ and } (1-w_t)^* = \frac{(1-w_t) + (1-w_{t-1})}{2}$$

In this study output is defined as a single product, and therefore the weighting of output was not necessary. Base year (1950) weights were applied to the inputs - capital and labor. For purposes of this analysis, these weights were defined as labor's and capital's share of the value of output. For the base year, labor's share was estimated to be approximately 40 percent. This was derived by taking total labor cost as a percent of the total revenue of the industry.

Despite the earlier observation about the limitations of base year weighting, the problem is somewhat mitigated in this case since the estimated labor's share remained fairly stable over the entire study period with the average annual share also being approximately 40 percent. This estimate is therefore considered a reasonably representative weight for labor. With labor's share estimated as 40 percent (i.e.  $b = 0.40$ ), capital's share was therefore taken to be 60 percent, (i.e.  $a = 1 - b = 0.60$ ; see Equation A-6).

### Results of Analysis

The results of the analysis of both total and partial factor productivity are presented in terms of six time periods. First, the average annual growth rates of productivity for the entire study period 1950-1980 are given. Then to compare the pre-jet era with the jet era, the time periods 1950-1957<sup>24</sup> and 1958-1980 were isolated. Next comparisons were made in terms of the developments in the three decades, hence the isolation of the periods 1950-1959, 1960-1969 and 1970-1980.

#### Total Factor Productivity

By applying Equation A-6 and the different definitions of the variables given earlier, the analysis of various combinations of inputs and outputs produced results that were generally consistent. That is, in general the results showed that total factor productivity was lowest in the pre-jet era, peaked during the decade of the 1960's and tended to decline during the decade of the 1970's.<sup>25</sup> However, the magnitudes of the changes varied among the different cases depending on what definitions of capital and output were employed. More specific details are given below.

Eight different cases were investigated. Four of these involved available output - tonne - kilometres available (TKA) and the four measures of capital defined earlier. The other four cases involved revenue output - tonne - kilometres

performed (TKP) and the same four measures of capital. For each subperiod the labor input was the same regardless of which measures of capital and output were used. The next four tables summarize the results of these eight cases.

As the data in these tables indicate, when output is measured in terms of tonne - kilometres available, the average annual growth rate of total factor productivity varied from a low of 3.95 percent to a high of 7.99 percent over the entire study period 1950 - 1980, depending on which measure of capital was used. For the pre-jet period 1950 - 1957, the range was 1.31 percent to 4.68 percent; and for the jet era 1958 - 1980 the range was 4.75 to 8.99 percent. During the fastest growth period 1960 - 1969, total factor productivity increased at annual rates ranging from 6.39 percent to 12.67 percent, and during the succeeding "decade" 1970 - 1980, the growth rates declined to range from 2.60 percent to 5.30 percent.

Similar patterns of productivity growth were observed when output was measured by tonne-kilometres performed, excepting that the rates were in general correspondingly lower than those associated with output measured in terms of tonne-kilometres available. Such results should be expected, and reflect the fact that demand (load factor) grew more slowly than output capacity. The notable exception was the period 1970 - 1980 for which the situation was reversed in every case. In addition, productivity actually increased during this period over the previous fast growth decade of the "sixties" in two cases (see Tables A-2 and A-4).

The implication is that the growth of output capacity slowed while load factor increased. This is plausible, because with the introduction of larger aircraft, unused capacity tends to be initially higher than subsequently when market forces cause capacity and demand to be better adjusted to each other. Such adjustment is indicated by changes in the load factor which gradually increased from 46 percent in 1971 to 58 percent in 1979 (Table A-5). Note that the load factor declined to its lowest level with the introduction into service of the wide-bodied jet aircraft starting with Boeing 747 in 1969, and followed by the Douglas DC-10 and Lockheed

TABLE A-1

AVERAGE ANNUAL PERCENTAGE GROWTH RATES OF TOTAL  
 FACTOR PRODUCTIVITY WITH INPUT COMBINATION I,  
 INTERNATIONAL SCHEDULED AIRLINES,\* ICAO  
 CONTRACTING STATES, 1950-1980.

| Period      | <u>Growth Rates with Respect to:</u> |                                    |                                   |                       |
|-------------|--------------------------------------|------------------------------------|-----------------------------------|-----------------------|
|             | <u>Tonne-Kilometres Available</u>    |                                    | <u>Tonne-Kilometres Performed</u> |                       |
|             | Mean                                 | Standard<br>Deviation<br>(Percent) | Mean                              | Standard<br>Deviation |
| 1950 - 1980 | 7.56                                 | 4.8                                | 7.19                              | 3.8                   |
| 1950 - 1957 | 4.65                                 | 2.5                                | 4.31                              | 2.9                   |
| 1958 - 1980 | 8.45                                 | 5.0                                | 8.07                              | 3.5                   |
| 1950 - 1959 | 6.17                                 | 4.2                                | 5.85                              | 4.4                   |
| 1960 - 1969 | 11.39                                | 5.3                                | 8.74                              | 3.0                   |
| 1970 - 1980 | 5.22                                 | 1.8                                | 6.84                              | 3.2                   |

Source: Table B-5.

Combination I consists of Capital measured by Aircraft Hours and Labor measured by Manhours.

\*Including their domestic operations.

TABLE A-2

AVERAGE ANNUAL PERCENTAGE GROWTH RATES OF TOTAL  
FACTOR PRODUCTIVITY WITH INPUT COMBINATION II,  
INTERNATIONAL SCHEDULED AIRLINES,\* ICAO  
CONTRACTING STATES, 1950-1980.

| Period      | <u>Growth Rates With Respect To:</u> |                                    |                                   |                       |
|-------------|--------------------------------------|------------------------------------|-----------------------------------|-----------------------|
|             | <u>Tonne-Kilometres Available</u>    |                                    | <u>Tonne-Kilometres Performed</u> |                       |
|             | Mean                                 | Standard<br>Deviation<br>(Percent) | Mean                              | Standard<br>Deviation |
| 1950 - 1980 | 3.95                                 | 4.0                                | 3.57                              | 3.7                   |
| 1950 - 1957 | 1.31                                 | 3.2                                | 1.00                              | 3.4                   |
| 1958 - 1980 | 4.75                                 | 3.9                                | 4.37                              | 3.6                   |
| 1950 - 1959 | 2.88                                 | 4.6                                | 2.56                              | 4.8                   |
| 1960 - 1969 | 6.39                                 | 4.2                                | 3.74                              | 2.9                   |
| 1970 - 1980 | 2.60                                 | 1.6                                | 4.26                              | 3.5                   |

Source: Table B-6.

Combination II consists of Capital measured by Aircraft Tonne - Hours, and Labor measured by Manhours.

\*Including their domestic operations.

TABLE A-3

AVERAGE ANNUAL PERCENTAGE GROWTH RATES OF TOTAL  
 FACTOR PRODUCTIVITY WITH INPUT COMBINATION III,  
 INTERNATIONAL SCHEDULED AIRLINES,\* ICAO  
 CONTRACTING STATES, 1950-1980.

| Period      | <u>Growth Rates With Respect To:</u> |                                    |                                   |                       |
|-------------|--------------------------------------|------------------------------------|-----------------------------------|-----------------------|
|             | <u>Tonne-Kilometres Available</u>    |                                    | <u>Tonne-Kilometres Performed</u> |                       |
|             | Mean                                 | Standard<br>Deviation<br>(Percent) | Mean                              | Standard<br>Deviation |
| 1950 - 1980 | 7.99                                 | 4.8                                | 7.63                              | 3.8                   |
| 1950 - 1957 | 4.68                                 | 2.5                                | 4.34                              | 2.8                   |
| 1958 - 1980 | 8.99                                 | 4.9                                | 8.63                              | 3.5                   |
| 1950 - 1959 | 6.07                                 | 3.5                                | 5.75                              | 3.7                   |
| 1960 - 1969 | 12.67                                | 4.4                                | 10.02                             | 2.3                   |
| 1970 - 1980 | 5.30                                 | 2.4                                | 6.96                              | 3.8                   |

Source: Table B-7

Combination III consists of Capital measured by Number of Aircraft and Labor measured by Manhours.

\*Including their domestic operations.



TABLE A-4

AVERAGE ANNUAL PERCENTAGE GROWTH RATES OF TOTAL  
FACTOR PRODUCTIVITY WITH INPUT COMBINATION IV,  
INTERNATIONAL SCHEDULED AIRLINES,\* ICAO  
CONTRACTING STATES, 1950-1980.

| Period      | <u>Growth Rates With Respect To:</u> |                                    |                                   |                       |
|-------------|--------------------------------------|------------------------------------|-----------------------------------|-----------------------|
|             | <u>Tonne-Kilometres Available</u>    |                                    | <u>Tonne-Kilometres Performed</u> |                       |
|             | Mean                                 | Standard<br>Deviation<br>(Percent) | Mean                              | Standard<br>Deviation |
| 1950 - 1980 | 4.99                                 | 3.8                                | 4.47                              | 3.3                   |
| 1950 - 1957 | 3.05                                 | 1.4                                | 2.71                              | 2.0                   |
| 1958 - 1980 | 5.58                                 | 4.2                                | 5.01                              | 3.3                   |
| 1950 - 1959 | 4.53                                 | 3.2                                | 3.51                              | 3.2                   |
| 1960 - 1969 | 7.13                                 | 4.9                                | 4.48                              | 2.6                   |
| 1970 - 1980 | 3.42                                 | 1.8                                | 4.69                              | 3.2                   |

Source: Table B-8.

Combination IV consists of Capital measured by Aircraft Capacity (see definition in text), and Labor measured by Manhours.

\*Including their domestic operations.

L-1011 in 1971 and 1972 respectively. Subsequently, the decline in load factor was gradually reversed to reach 58 percent in 1979.

It should also be observed that the growth rate of total factor productivity was highest when capital was measured in terms of aircraft number and lowest when capital was measured by aircraft tonne-hours. For given output levels, lower productivity increase suggests larger quantities or less efficient use of inputs. The capital content of aircraft which is related to their size has increased much faster when measured by tonne-hours than by number of aircraft. For instance when these measurements are converted into index numbers with a common base year, it is observed that aircraft tonne-hours were 18.99 times larger in 1980 than in 1950, whereas aircraft numbers were only 2.86 times as large in 1980 as in 1950 (see Appendix Table B-3).

These differences reflect the fact that over the years aircraft of larger sizes were introduced into service. Thus the measure tonne-hours serves as an adjustment to aircraft numbers as well as aircraft hours flown by taking into account the size of aircraft. Capital measured in terms of aircraft capacity makes similar adjustment for size but as the index numbers indicate this measure does not make as great an adjustment as aircraft tonne-hours.

#### Partial Factor Productivity

Given the limitations of partial productivity measures noted earlier, the following results should be interpreted with caution. It will be observed however that the pattern of productivity growth indicated by these measures is similar to that derived by the foregoing total productivity analysis. That is, in general the growth rate of productivity tended to be lowest during the 1950-1957 pre-jet period, to be highest during the decade of the 1960's and showed a slowing trend during the 1970's. Again there were exceptions to this general pattern of productivity growth as indicated by the cases in which capital was measured by aircraft

TABLE A-5

LOAD FACTOR OF INTERNATIONAL SCHEDULED AIRLINES,\*  
ICAO CONTRACTING STATES,+ 1960-1980.

| Year | Weight Load Factor<br>(Percent) |
|------|---------------------------------|
| 1960 | 55                              |
| 1961 | 52                              |
| 1962 | 51                              |
| 1963 | 51                              |
| 1964 | 51                              |
| 1965 | 52                              |
| 1966 | 53                              |
| 1967 | 51                              |
| 1968 | 49                              |
| 1969 | 48                              |
| 1970 | 47                              |
| 1971 | 46                              |
| 1972 | 49                              |
| 1973 | 50                              |
| 1974 | 51                              |
| 1975 | 50                              |
| 1976 | 52                              |
| 1977 | 53                              |
| 1978 | 56                              |
| 1979 | 58                              |
| 1980 | 58                              |

Source: International Civil Aviation Organization, A Review of the Economic Situation of Air Transport, Circular 105-AT/26, Circular 122-AT/32 and Circular 158-AT/57.

\*Including their domestic operations.

+Excluding U.S.S.R.

tonne-hours and aircraft capacity. Such deviations from the pattern can in part be explained by the adjustment for size of aircraft which these measures of capital make, as observed above.

The growth of labor productivity was consistent with the general pattern described above, whether output was measured in terms of tonne-kilometres available or tonne-kilometres performed. Note that for each subperiod excepting 1970-1980 the growth rate of labor productivity was lower when output was measured by tonne-kilometres performed instead of tonne-kilometres available (Table A-8). This again should perhaps be expected, for it reflects the fact that total output (TKA) had been growing faster than revenue output (TKP). The reversed picture for 1970-1980 suggests as indicated earlier a slowing down of capacity offered relative to capacity sold. The partial productivity results are summarized in tabular form below.

TABLE A-6

CAPITAL PRODUCTIVITY WITH RESPECT TO OUTPUT MEASURED IN TERMS OF TONNE-KILOMETRES AVAILABLE AND FOUR MEASURES OF CAPITAL, 1950-1980, BY SUBPERIODS.

| Period    | Annual Percentage Growth Rates |                    |           |                    |           |                    |           |                    |
|-----------|--------------------------------|--------------------|-----------|--------------------|-----------|--------------------|-----------|--------------------|
|           | $X_1/K_1$                      |                    | $X_1/K_2$ |                    | $X_1/K_3$ |                    | $X_1/K_4$ |                    |
|           | Mean                           | Standard Deviation | Mean      | Standard Deviation | Mean      | Standard Deviation | Mean      | Standard Deviation |
| 1950-1980 | 7.6                            | 4.8                | 2.8       | 2.7                | 8.4       | 4.9                | 3.4       | 3.0                |
| 1950-1957 | 5.2                            | 3.7                | 3.5       | 2.4                | 5.1       | 3.8                | 2.4       | 2.3                |
| 1958-1980 | 8.4                            | 4.9                | 2.6       | 2.4                | 9.3       | 4.7                | 3.7       | 3.5                |
| 1950-1959 | 6.6                            | 4.9                | 4.1       | 3.3                | 6.3       | 4.0                | 3.7       | 3.4                |
| 1960-1969 | 11.3                           | 5.1                | 3.2       | 3.1                | 13.5      | 3.3                | 4.3       | 4.1                |
| 1970-1980 | 5.2                            | 1.5                | 1.3       | 1.0                | 5.4       | 2.3                | 2.2       | 2.0                |

Source: Table B-9.

Notes  $X_1$  = Tonne-Kilometres Available;  $K_1$  = Capital measured in terms of Aircraft Hours Flown;  $K_2$  = Capital measured in terms of Aircraft Tonne-Hours;  $K_3$  = Capital measured in terms of Number of Aircraft;  $K_4$  = Capital measured in terms of Aircraft Capacity (see definitions earlier in this appendix).

TABLE A-7

CAPITAL PRODUCTIVITY WITH RESPECT TO OUTPUT MEASURED IN TERMS OF TONNE-KILOMETRES PERFORMED AND FOUR MEASURES OF CAPITAL, 1950-1980, BY SUBPERIODS.

| Period    | Annual Percentage Growth Rates |                    |                   |                    |                   |                    |                   |                    |
|-----------|--------------------------------|--------------------|-------------------|--------------------|-------------------|--------------------|-------------------|--------------------|
|           | $\frac{X_2}{K_1}$              |                    | $\frac{X_2}{K_2}$ |                    | $\frac{X_2}{K_3}$ |                    | $\frac{X_2}{K_4}$ |                    |
|           | Mean                           | Standard Deviation | Mean              | Standard Deviation | Mean              | Standard Deviation | Mean              | Standard Deviation |
| 1950-1980 | 7.3                            | 4.1                | 1.40              | 4.0                | 8.0               | 4.2                | 3.4               | 4.8                |
| 1950-1957 | 4.8                            | 3.9                | 0.00              | 4.2                | 5.1               | 3.4                | 2.8               | 2.0                |
| 1958-1980 | 8.1                            | 3.8                | 2.00              | 4.0                | 9.0               | 3.9                | 3.4               | 5.3                |
| 1950-1959 | 6.3                            | 5.1                | 0.01              | 5.2                | 6.1               | 4.0                | 4.0               | 3.1                |
| 1960-1969 | 8.8                            | 3.6                | 0.01              | 3.6                | 10.9              | 2.7                | 2.1               | 6.1                |
| 1970-1980 | 6.8                            | 3.2                | 2.30              | 3.5                | 7.0               | 4.2                | 3.8               | 4.2                |

Source: Table B-10.

Notes:  $X_2$  = Tonne-Kilometres Performed;  $K_1$  = Capital measured in terms of Aircraft Hours Flown;  $K_2$  = Capital measured in terms of Aircraft Tonne-Hours;  $K_3$  = Capital measured in terms of Number of Aircraft;  $K_4$  = Capital measured in terms of Aircraft Capacity (see definitions earlier in this appendix).



TABLE A-8

LABOR PRODUCTIVITY WITH RESPECT TO OUTPUT MEASURED IN  
TERMS OF TONNE-KILOMETRES AVAILABLE AND TONNE-  
KILOMETRES PERFORMED, 1950-1980 BY SUBPERIODS.

| Period    | <u>Annual Percentage Growth Rates</u> |                       |                           |                       |
|-----------|---------------------------------------|-----------------------|---------------------------|-----------------------|
|           | <u><math>X_1/N</math></u>             |                       | <u><math>X_2/N</math></u> |                       |
|           | Mean                                  | Standard<br>Deviation | Mean                      | Standard<br>Deviation |
| 1950-1980 | 6.7                                   | 5.0                   | 6.4                       | 3.7                   |
| 1950-1957 | 3.5                                   | 2.0                   | 3.2                       | 2.6                   |
| 1958-1980 | 7.7                                   | 5.3                   | 7.4                       | 3.6                   |
| 1950-1959 | 5.1                                   | 3.8                   | 4.8                       | 4.2                   |
| 1960-1969 | 10.2                                  | 6.2                   | 7.6                       | 3.4                   |
| 1970-1980 | 5.0                                   | 2.5                   | 6.6                       | 3.4                   |

Source: Table B-11.

Notes:  $X_1$  = Tonne-Kilometres Available;  $X_2$  = Tonne-Kilometres Performed; N = Labor Input measured in terms of Manhours worked annually.

## APPENDIX A

## NOTES

1. Cf. M. Ishaq Nadiri, "Measurement of Total Factor Productivity: A Survey," in Journal of Economic Literature, December 1970, pp. 1137-1177.
2. Cf. Evsey D. Domar, "On Total Productivity and All That," in Journal of Political Economy, December 1962, pp. 597-608.
3. Cf. P. S. Dhruvarajan and R. F. Harris, A Productivity Study of the Canadian Airline Industry, Canadian Transport Commission - Research Branch, Report No. 10-78-03, March 1978, p. 6.
4. J. W. Kendrick, Productivity Trends in the United States, Arno Press, New York, 1975 (Reprint - NBER Publications).
5. R. Solow, "Technical Change and the Aggregate Production Function" in Review of Economic Statistics, August 1957, pp. 312-320.
6. These assumptions include pure competition and linear homogeneity of the production function. This suggests that technological change is solely responsible for any changes in the marginal product of capital and labor, and that the ratios of these marginal products are constant and unaffected by the ratios of the quantities of these inputs. Cf. Edwin Mansfield, The Economics of Technical Change, W. W. Norton and Company, Inc., New York, 1968, p. 27. Kendrick claims to avoid the assumption of linear homogeneity on which the Cobb-Douglas production function is based, by occasionally changing the weights of capital and labor in his analysis. See J. W. Kendrick and M. R. Pech, Postwar Productivity Trends in the United States, 1948-1969, Columbia University Press (NBER), New York, 1973, p. 14.
7. Cf. M. Ishaq Nadiri, op. cit.; and E. Levhari, E. Kleiman and N. Halevi, "The Relationship Between Two Measures of Total Productivity," The Review of Economics and Statistics, August 1966, pp. 345-347.
8. The definition of capital used in this study is given later in this appendix.
9. See for example Douglas W. Caves, Laurits R. Christensen and Michael W. Tretheway, "U. S. Trunk Air Carriers, 1972-1977; A Multilateral Comparison of Total Factor Productivity," in Thomas G. Cowing and Rodney E. Stevenson, editors, Productivity Measurement in Regulated Industries, Academic Press, New York, 1981, pp. 47-76; also P. S. Dhruvarajan and R. F. Harris, op. cit.
10. See for example, R. C. Scheppach and L. C. Woehlcke, Transportation Productivity, D. C. Heath and Company, Lexington, Massachusetts, 1975; A. P. Ellison and E. M. Stafford, The Dynamics of the Civil Aviation Industry, D. C. Heath and Company, Lexington, Massachusetts, 1974; J. W. Kendrick, op. cit.; J. W. Kendrick, "Some Theoretical Issues in Capital Measurement," American Economic Review, May 1961, pp. 102-111; and G. Jaszi, et. al. "Expansion of

Fixed Business Capital in the United States," Survey of Current Business, November 1962.

11. Mahlon R. Straszheim, op. cit., p. 58.
12. Murray Brown and Joel Popkin, "A Measure of Technological Change and Returns to Scale", in Review of Economics and Statistics, Volume 42, p. 410.
13. Cf. P. S. Dhruvarajan and R. F. Harris, op. cit., p. 25.
14. Ibid., p. 28.
15. A. P. Ellison and E. M. Stafford, op. cit., pp. 149-153.
16. Such deterioration does not appear to be crucial in the case of aircraft, for as noted above, a ten year old aircraft can perform as well or better than when it was new. Dhruvarajan and Harris, (op. cit.) in their investigation confirmed that there is a rather slow decline in the productive capability of aircraft, and consequently assumed zero rate of depreciation in their analysis. Douglas W. Caves, Laurits R. Christensen and Michael W. Thretheway (op. cit.) in their analysis assumed that "the flow of capital services for an aircraft in a given category is independent of its age," and presented supporting evidence from the daily utilization rates of different aircraft types introduced into service over an eleven year period.
17. The product thus derived is the definition of average productive capacity used by the International Civil Aviation Organization (ICAO) in several of its publications.
18. Douglas W. Caves, Laurits R. Christensen and Michael W. Thretheway, op. cit.
19. Again it should be pointed out that these are industry aggregates. Note also that all these measures are based on the aircraft. In the two-input context they understate capital input since aircraft are not the only capital component in the air transportation industry. However, since aircraft are by far the predominant component (accounting for about 80 percent of capital investment - see Mahlon R. Straszheim, op. cit. p. 102), this study considers them a reasonable approximation of capital input.
20. Dhruvarajan and Harris, op. cit. used gross take-off weight instead of payload capacity. That approach was not feasible for this study since it would involve examining the fleet each year for airlines of more than one hundred and forty countries - many of these countries owning several airlines. The ICAO provides data on average payload capacity but not average gross take-off weight. Instead it reports "aircraft with maximum take-off weight of 9 tonnes or more." An examination of the gross take-off weight and payload capacity of several aircraft types revealed a direct relationship between the two in both absolute and ratio terms.
21. This discussion draws heavily from R. C. Scheppach and L. C. Woehleke, op. cit., pp. 40-43.
22. Cf. P. S. Dhruvarajan and R. F. Harris, op. cit., p. 16.

23. R. C. Scheppach and L. C. Woehleke, op. cit., p. 42.
24. It is recognized that this is a relatively short time period to compare with the jet era. However it was considered long enough to indicate some trend. Furthermore, given the available data prior to 1950 not much improvement in the quality of the results was anticipated from the inclusion of pre-1950 data.
25. Cf. Earlier findings of this study (Chapter II).

## APPENDIX B

### TABLES

TABLE B-1

ABSOLUTE VALUES OF INPUTS, INTERNATIONAL SCHEDULED  
AIRLINES,\* ICAO CONTRACTING STATES, 1950-1980.

| Year | Inputs                   |                          |                |                |                 |
|------|--------------------------|--------------------------|----------------|----------------|-----------------|
|      | K <sub>1</sub><br>(,000) | K <sub>2</sub><br>(,000) | K <sub>3</sub> | K <sub>4</sub> | N<br>(,000,000) |
| 1950 | 3901                     | 15994                    | 3061           | 1181           | 451.6           |
| 1951 | 4183                     | 17987                    | 3253           | 1260           | 463.4           |
| 1952 | 4478                     | 21047                    | 3515           | 1405           | 505.2           |
| 1953 | 4502                     | 22060                    | 3514           | 1499           | 539.4           |
| 1954 | 4539                     | 23603                    | 3563           | 1633           | 581.0           |
| 1955 | 4811                     | 25979                    | 3757           | 1739           | 638.2           |
| 1956 | 5123                     | 29201                    | 4021           | 1887           | 677.8           |
| 1957 | 5588                     | 32969                    | 4386           | 2024           | 718.2           |
| 1958 | 5950                     | 36890                    | 4520           | 2170           | 762.4           |
| 1959 | 6023                     | 39150                    | 4817           | 2314           | 789.2           |
| 1960 | 6184                     | 44525                    | 5014           | 2606           | 806.6           |
| 1961 | 6258                     | 51941                    | 5122           | 3254           | 815.4           |
| 1962 | 6347                     | 58392                    | 5213           | 3846           | 825.2           |
| 1963 | 6478                     | 63484                    | 5288           | 4273           | 902.0           |
| 1964 | 6787                     | 71264                    | 5425           | 4704           | 990.0           |
| 1965 | 7367                     | 81774                    | 5583           | 5206           | 1074.0          |
| 1966 | 7889                     | 91512                    | 5781           | 5603           | 1216.0          |
| 1967 | 9325                     | 113765                   | 6157           | 6320           | 1368.0          |
| 1968 | 10122                    | 131586                   | 6719           | 7124           | 1498.0          |
| 1969 | 10796                    | 150064                   | 7062           | 7923           | 1572.0          |
| 1970 | 11175                    | 159803                   | 7275           | 8323           | 1584.0          |
| 1971 | 11389                    | 176530                   | 7343           | 9099           | 1602.0          |
| 1972 | 11563                    | 188477                   | 7464           | 9633           | 1674.0          |
| 1973 | 11990                    | 207427                   | 7616           | 10224          | 1710.0          |
| 1974 | 11870                    | 214847                   | 7857           | 10697          | 1740.0          |
| 1975 | 11910                    | 223908                   | 8113           | 11224          | 1770.0          |
| 1976 | 12077                    | 234294                   | 8246           | 11679          | 1830.0          |
| 1977 | 12500                    | 251250                   | 8339           | 12181          | 1860.0          |
| 1978 | 13032                    | 267156                   | 8380           | 12464          | 1910.0          |
| 1979 | 13270                    | 285305                   | 8590           | 13137          | 1960.0          |
| 1980 | 13550                    | 302165                   | 8757           | 13715          | 2020.0          |

Source: Based on data provided by International Civil Aviation Organization, A Review of the Economic Situation of Air Transport, Circulars 73-AT/10; 105-AT/26; 122-AT/32 and 158-AT/57; The Economic Implications of the Introduction Into Service of Long-Range Jet Aircraft, Doc. 7894-C/907.

Notes: \*Including their domestic operations.  
 K<sub>1</sub> = Capital measured in terms of Aircraft Hours Flown.  
 K<sub>2</sub> = Capital measured in terms of Aircraft Tonne-Hours.  
 K<sub>3</sub> = Capital measured in terms of Number of Aircraft.  
 K<sub>4</sub> = Capital measured in terms of Aircraft Capacity.  
 N = Labor measured in terms of Manhours.  
 See Appendix A for definition of these inputs.



TABLE B-2

ABSOLUTE VALUES OF OUTPUT, INTERNATIONAL SCHEDULED  
AIRLINES,\* ICAO CONTRACTING STATES, 1950-1980.

| Year | $X_1$  | <u>Output</u> | $X_2$  |
|------|--------|---------------|--------|
|      |        | (millions)    |        |
| 1950 | 6500   |               | 3970   |
| 1951 | 6960   |               | 4190   |
| 1952 | 7580   |               | 4560   |
| 1953 | 8350   |               | 5040   |
| 1954 | 9380   |               | 5580   |
| 1955 | 10480  |               | 6130   |
| 1956 | 11640  |               | 6980   |
| 1957 | 13150  |               | 7860   |
| 1958 | 14920  |               | 8880   |
| 1959 | 17630  |               | 10490  |
| 1960 | 22320  |               | 12340  |
| 1961 | 26070  |               | 13480  |
| 1962 | 29720  |               | 15100  |
| 1963 | 33550  |               | 16960  |
| 1964 | 38640  |               | 19780  |
| 1965 | 45370  |               | 23450  |
| 1966 | 52020  |               | 27510  |
| 1967 | 64290  |               | 32620  |
| 1968 | 79320  |               | 38550  |
| 1969 | 90970  |               | 43350  |
| 1970 | 100470 |               | 47750  |
| 1971 | 109570 |               | 50560  |
| 1972 | 117840 |               | 57430  |
| 1973 | 129800 |               | 64580  |
| 1974 | 133540 |               | 68450  |
| 1975 | 141460 |               | 71180  |
| 1976 | 152020 |               | 78760  |
| 1977 | 162410 |               | 86210  |
| 1978 | 174220 |               | 98080  |
| 1979 | 189500 |               | 109250 |
| 1980 | 199430 |               | 111720 |

Source: Based on data provided by International Civil Aviation Organization, A Review of the Economic Situation of Air Transport, Circulars 73-AT/10; 105-AT/26; 122-AT/32 and 158-AT/57; The Economic Implications of Long-Range Jet Aircraft, Doc. 7894 - C/907.

Notes: \*Including their domestic operations.

$X_1$  = Tonne-Kilometres Available (Total Output).

$X_2$  = Tonne-Kilometres Performed (Revenue Output).

TABLE B-3

INDICES OF INPUTS, INTERNATIONAL SCHEDULED AIRLINES,\*  
ICAO CONTRACTING STATES, 1950-1980.

| Year | Inputs         |                |                                |                |       |
|------|----------------|----------------|--------------------------------|----------------|-------|
|      | K <sub>1</sub> | K <sub>2</sub> | K <sub>3</sub><br>(1950 = 100) | K <sub>4</sub> | N     |
| 1950 | 100.0          | 100.0          | 100.0                          | 100.0          | 100.0 |
| 1951 | 107.2          | 112.5          | 106.3                          | 106.7          | 102.6 |
| 1952 | 114.8          | 131.6          | 114.8                          | 119.0          | 111.9 |
| 1953 | 115.4          | 137.9          | 114.8                          | 126.9          | 119.4 |
| 1954 | 116.4          | 147.6          | 116.4                          | 138.3          | 128.7 |
| 1955 | 123.3          | 162.4          | 122.7                          | 147.2          | 141.3 |
| 1956 | 131.3          | 182.6          | 131.4                          | 159.8          | 150.1 |
| 1957 | 143.2          | 206.1          | 143.3                          | 171.4          | 159.0 |
| 1958 | 152.5          | 230.6          | 147.7                          | 183.7          | 168.8 |
| 1959 | 154.4          | 244.8          | 157.4                          | 195.9          | 174.8 |
| 1960 | 158.5          | 278.4          | 163.8                          | 220.7          | 178.6 |
| 1961 | 160.4          | 324.8          | 167.3                          | 275.5          | 180.6 |
| 1962 | 162.7          | 365.1          | 170.3                          | 325.7          | 182.7 |
| 1963 | 166.1          | 396.9          | 172.8                          | 361.8          | 199.7 |
| 1964 | 174.0          | 445.6          | 177.2                          | 398.3          | 219.2 |
| 1965 | 188.8          | 511.3          | 182.4                          | 440.8          | 237.8 |
| 1966 | 202.2          | 572.2          | 188.9                          | 474.4          | 269.3 |
| 1967 | 239.0          | 711.3          | 201.1                          | 535.1          | 302.9 |
| 1968 | 259.5          | 822.7          | 219.5                          | 603.2          | 331.7 |
| 1969 | 276.7          | 938.3          | 230.7                          | 670.9          | 348.1 |
| 1970 | 286.5          | 999.1          | 237.7                          | 704.7          | 350.8 |
| 1971 | 292.0          | 1103.7         | 239.9                          | 770.4          | 354.7 |
| 1972 | 296.4          | 1178.4         | 243.8                          | 815.7          | 370.7 |
| 1973 | 307.4          | 1296.9         | 248.8                          | 865.7          | 378.7 |
| 1974 | 304.3          | 1343.3         | 256.7                          | 905.8          | 385.3 |
| 1975 | 305.3          | 1399.9         | 265.0                          | 950.4          | 391.9 |
| 1976 | 309.6          | 1464.9         | 269.4                          | 988.9          | 405.2 |
| 1977 | 320.4          | 1570.1         | 272.4                          | 1031.4         | 411.9 |
| 1978 | 334.1          | 1670.4         | 273.8                          | 1055.4         | 422.9 |
| 1979 | 340.2          | 1783.8         | 280.1                          | 1112.4         | 434.0 |
| 1980 | 347.3          | 1889.2         | 286.1                          | 1161.3         | 447.3 |

Source: Computed from Table B-1.

Notes: \*Including their domestic operations.

K<sub>1</sub> = Capital measured in terms of Aircraft Hours Flown.

K<sub>2</sub> = Capital measured in terms of Aircraft Tonne-Hours.

K<sub>3</sub> = Capital measured in terms of Number of Aircraft.

K<sub>4</sub> = Capital measured in terms of Aircraft Capacity.

N = Labor measured in terms of Manhours.

See Appendix A for definition of these inputs.

TABLE B-4  
 INDICES OF OUTPUT, INTERNATIONAL SCHEDULED AIRLINES,\*  
 ICAO CONTRACTING STATES, 1950-1980.

| Year | <u>Output</u>         |        |
|------|-----------------------|--------|
|      | $X_1$<br>(1950 = 100) | $X_2$  |
| 1950 | 100.0                 | 100.0  |
| 1951 | 107.1                 | 105.5  |
| 1952 | 116.6                 | 114.9  |
| 1953 | 128.5                 | 127.0  |
| 1954 | 144.3                 | 140.6  |
| 1955 | 161.2                 | 154.4  |
| 1956 | 179.1                 | 175.8  |
| 1957 | 202.3                 | 198.0  |
| 1958 | 229.5                 | 223.7  |
| 1959 | 271.2                 | 264.2  |
| 1960 | 343.4                 | 310.8  |
| 1961 | 401.1                 | 339.5  |
| 1962 | 457.2                 | 380.4  |
| 1963 | 516.2                 | 427.2  |
| 1964 | 594.5                 | 498.2  |
| 1965 | 698.0                 | 590.7  |
| 1966 | 800.3                 | 692.9  |
| 1967 | 989.1                 | 821.7  |
| 1968 | 1220.3                | 971.0  |
| 1969 | 1399.5                | 1091.9 |
| 1970 | 1545.7                | 1202.8 |
| 1971 | 1685.7                | 1273.6 |
| 1972 | 1812.9                | 1446.6 |
| 1973 | 1996.9                | 1626.7 |
| 1974 | 2054.7                | 1724.2 |
| 1975 | 2176.3                | 1792.9 |
| 1976 | 2338.8                | 1983.9 |
| 1977 | 2498.6                | 2171.5 |
| 1978 | 2680.3                | 2470.5 |
| 1979 | 2915.4                | 2751.9 |
| 1980 | 3068.2                | 2814.1 |

Source: Computed from Table B-2.

Notes: \*Including their domestic operations.

$X_1$  = Tonne-Kilometres Available (Total Output).

$X_2$  = Tonne-Kilometres Performed (Revenue Output).

TABLE B-5

ANNUAL PERCENTAGE GROWTH RATES OF TOTAL FACTOR  
PRODUCTIVITY WITH INPUT COMBINATION I,  
INTERNATIONAL SCHEDULED AIRLINES\*,  
ICAO CONTRACTING STATES, 1950-1980.

| Year | <u>Growth Rates With Respect To</u> |                               |
|------|-------------------------------------|-------------------------------|
|      | Tonne-Kilometres<br>Available       | Tonne-Kilometres<br>Performed |
|      | (Percent)                           |                               |
| 1950 | -                                   | -                             |
| 1951 | 1.7                                 | 0.1                           |
| 1952 | 1.0                                 | 1.0                           |
| 1953 | 7.2                                 | 7.5                           |
| 1954 | 8.6                                 | 7.0                           |
| 1955 | 4.2                                 | 2.3                           |
| 1956 | 4.7                                 | 7.5                           |
| 1957 | 5.2                                 | 4.8                           |
| 1958 | 7.0                                 | 6.6                           |
| 1959 | 16.0                                | 15.9                          |
| 1960 | 24.1                                | 15.1                          |
| 1961 | 15.6                                | 8.0                           |
| 1962 | 12.7                                | 10.7                          |
| 1963 | 7.9                                 | 7.3                           |
| 1964 | 8.4                                 | 9.8                           |
| 1965 | 8.9                                 | 10.1                          |
| 1966 | 5.2                                 | 7.8                           |
| 1967 | 7.7                                 | 2.7                           |
| 1968 | 14.6                                | 9.4                           |
| 1969 | 8.8                                 | 6.5                           |
| 1970 | 8.0                                 | 7.8                           |
| 1971 | 7.5                                 | 4.3                           |
| 1972 | 4.8                                 | 10.9                          |
| 1973 | 7.0                                 | 9.3                           |
| 1974 | 2.8                                 | 5.9                           |
| 1975 | 5.0                                 | 3.1                           |
| 1976 | 5.3                                 | 8.5                           |
| 1977 | 4.1                                 | 6.8                           |
| 1978 | 3.6                                 | 10.1                          |
| 1979 | 6.7                                 | 9.3                           |
| 1980 | 2.7                                 | -0.2                          |

Source: Based on Equation A-6 and data given in Tables B-3 and B-4.

Combination I consists of Capital measured by Aircraft Hours Flown and Labor measured by Manhours.

\*Including their domestic operations.

TABLE B-6

ANNUAL PERCENTAGE GROWTH RATES OF TOTAL FACTOR  
PRODUCTIVITY WITH INPUT COMBINATION II,  
INTERNATIONAL SCHEDULED AIRLINES,\*  
ICAO CONTRACTING STATES, 1950-1980.

| Year | <u>Growth Rates With Respect To:</u> |                              |
|------|--------------------------------------|------------------------------|
|      | Tonne-Kilometres<br>Available        | Tonne-Kilometres<br>Perormed |
|      | (Percent)                            |                              |
| 1950 | -                                    | -                            |
| 1951 | -1.4                                 | -3.0                         |
| 1952 | -4.9                                 | -4.9                         |
| 1953 | 4.6                                  | 4.9                          |
| 1954 | 5.0                                  | 3.4                          |
| 1955 | 1.8                                  | -0.1                         |
| 1956 | 1.2                                  | 4.0                          |
| 1957 | 2.9                                  | 2.5                          |
| 1958 | 3.8                                  | 3.4                          |
| 1959 | 13.0                                 | 12.9                         |
| 1960 | 17.5                                 | 8.5                          |
| 1961 | 6.3                                  | -1.3                         |
| 1962 | 6.1                                  | 4.1                          |
| 1963 | 4.0                                  | 3.4                          |
| 1964 | 3.9                                  | 5.3                          |
| 1965 | 5.2                                  | 6.4                          |
| 1966 | 2.3                                  | 4.9                          |
| 1967 | 4.0                                  | -1.0                         |
| 1968 | 10.3                                 | 5.1                          |
| 1969 | 4.3                                  | 2.0                          |
| 1970 | 6.2                                  | 6.0                          |
| 1971 | 2.4                                  | -0.8                         |
| 1972 | 1.6                                  | 7.7                          |
| 1973 | 3.2                                  | 5.5                          |
| 1974 | 0.1                                  | 3.2                          |
| 1975 | 2.7                                  | 0.8                          |
| 1976 | 4.1                                  | 7.3                          |
| 1977 | 1.8                                  | 4.5                          |
| 1978 | 2.4                                  | 8.9                          |
| 1979 | 3.7                                  | 6.3                          |
| 1980 | 0.4                                  | -2.5                         |

Source: Based on Equation A-6 and data given in Tables B-3 and B-4.

Combination II consists of Capital measured by Aircraft Tonne-Hours and Labor measured by Manhours.

\*Including their domestic operations.

TABLE B-7

ANNUAL PERCENTAGE GROWTH RATES OF TOTAL FACTOR  
PRODUCTIVITY WITH INPUT COMBINATION III,  
INTERNATIONAL SCHEDULED AIRLINES,\*  
ICAO CONTRACTING STATES, 1950-1980.

| Year | <u>Growth Rates With Respect To:</u> |                               |
|------|--------------------------------------|-------------------------------|
|      | Tonne-Kilometres<br>Available        | Tonne-Kilometres<br>Performed |
|      | (Percent)                            |                               |
| 1950 | -                                    | -                             |
| 1951 | 2.3                                  | 0.7                           |
| 1952 | 0.6                                  | 0.6                           |
| 1953 | 7.5                                  | 7.8                           |
| 1954 | 8.3                                  | 6.7                           |
| 1955 | 4.5                                  | 2.6                           |
| 1956 | 4.4                                  | 7.2                           |
| 1957 | 5.2                                  | 4.8                           |
| 1958 | 9.1                                  | 8.7                           |
| 1959 | 12.8                                 | 12.7                          |
| 1960 | 23.3                                 | 14.3                          |
| 1961 | 15.1                                 | 7.5                           |
| 1962 | 12.4                                 | 10.4                          |
| 1963 | 8.3                                  | 7.7                           |
| 1964 | 9.8                                  | 11.2                          |
| 1965 | 12.3                                 | 13.5                          |
| 1966 | 7.3                                  | 9.9                           |
| 1967 | 14.8                                 | 9.8                           |
| 1968 | 14.3                                 | 9.1                           |
| 1969 | 9.1                                  | 6.8                           |
| 1970 | 8.3                                  | 8.1                           |
| 1971 | 8.1                                  | 4.9                           |
| 1972 | 4.7                                  | 10.8                          |
| 1973 | 8.0                                  | 10.3                          |
| 1974 | 0.3                                  | 3.4                           |
| 1975 | 3.3                                  | 1.4                           |
| 1976 | 5.1                                  | 8.3                           |
| 1977 | 5.5                                  | 8.2                           |
| 1978 | 5.9                                  | 12.4                          |
| 1979 | 6.4                                  | 9.0                           |
| 1980 | 2.7                                  | -0.2                          |

Source: Based on Equation A-6 and data given in Tables B-3 and B-4.

Combination III consists of Capital measured by Number of Aircraft and Labor measured by Manhours.

\*Including their domestic operations.



TABLE B-8

ANNUAL PERCENTAGE GROWTH RATES OF TOTAL FACTOR  
PRODUCTIVITY WITH INPUT COMBINATION IV,  
INTERNATIONAL SCHEDULED AIRLINES,\*  
ICAO CONTRACTING STATES, 1950-1980.

| Year | <u>Growth Rates With Respect To:</u> |                               |
|------|--------------------------------------|-------------------------------|
|      | Tonne-Kilometres<br>Available        | Tonne-Kilometres<br>Performed |
|      | (Percent)                            |                               |
| 1950 | -                                    | -                             |
| 1951 | 2.0                                  | 0.4                           |
| 1952 | -1.6                                 | -1.6                          |
| 1953 | 3.5                                  | 3.8                           |
| 1954 | 3.8                                  | 2.2                           |
| 1955 | 3.9                                  | 2.0                           |
| 1956 | 3.5                                  | 6.3                           |
| 1957 | 6.3                                  | 5.9                           |
| 1958 | 6.6                                  | 6.2                           |
| 1959 | 12.8                                 | 12.7                          |
| 1960 | 18.1                                 | 9.1                           |
| 1961 | 1.4                                  | -6.2                          |
| 1962 | 2.6                                  | 0.6                           |
| 1963 | 2.5                                  | 1.9                           |
| 1964 | 5.2                                  | 6.6                           |
| 1965 | 7.6                                  | 8.8                           |
| 1966 | 4.9                                  | 7.5                           |
| 1967 | 10.9                                 | 5.9                           |
| 1968 | 12.1                                 | 6.9                           |
| 1969 | 6.0                                  | 3.7                           |
| 1970 | 7.1                                  | 6.9                           |
| 1971 | 3.1                                  | -0.1                          |
| 1972 | 2.2                                  | 8.3                           |
| 1973 | 5.6                                  | 7.9                           |
| 1974 | -0.5                                 | 2.6                           |
| 1975 | 2.3                                  | 0.4                           |
| 1976 | 3.7                                  | 2.5                           |
| 1977 | 3.6                                  | 6.3                           |
| 1978 | 4.8                                  | 11.3                          |
| 1979 | 4.5                                  | 7.1                           |
| 1980 | 1.3                                  | -1.6                          |

Source: Based on Equation A-6 and data given in Tables B-3 and B-4.

Combination IV consists of Capital measured by Aircraft Capacity (defined in Appendix A) and Labor measured by Manhours.

\*Including their domestic operations.

TABLE B-9

ANNUAL PERCENTAGE GROWTH RATES OF CAPITAL PRODUCTIVITY  
WITH RESPECT TO OUTPUT MEASURED IN TERMS OF TONNE-  
KILOMETRES AVAILABLE, INTERNATIONAL SCHEDULED  
AIRLINES,\* ICAO CONTRACTING STATES, 1950-1980.

| Year | Growth Rates |                        |           |           |
|------|--------------|------------------------|-----------|-----------|
|      | $X_1/K_1$    | $X_1/K_2$<br>(Percent) | $X_1/K_3$ | $X_1/K_4$ |
| 1950 | -            | -                      | -         | -         |
| 1951 | -0.1         | -4.8                   | 0.8       | 0.4       |
| 1952 | 1.7          | -6.9                   | 0.8       | -2.4      |
| 1953 | 9.6          | 5.2                    | 10.2      | 3.3       |
| 1954 | 11.3         | 4.9                    | 10.7      | 3.0       |
| 1955 | 5.5          | 1.5                    | 6.0       | 5.0       |
| 1956 | 4.3          | -1.2                   | 3.8       | 2.3       |
| 1957 | 3.6          | 0.1                    | 3.6       | 5.3       |
| 1958 | 6.5          | 1.4                    | 10.1      | 5.9       |
| 1959 | 16.7         | 11.3                   | 10.9      | 10.8      |
| 1960 | 23.3         | 11.3                   | 21.7      | 12.4      |
| 1961 | 15.4         | 0.1                    | 14.4      | -6.4      |
| 1962 | 12.4         | 1.4                    | 12.0      | -3.6      |
| 1963 | 10.6         | 3.9                    | 11.3      | 1.6       |
| 1964 | 9.9          | 2.6                    | 12.3      | 4.6       |
| 1965 | 8.2          | 2.3                    | 14.1      | 6.1       |
| 1966 | 7.1          | 2.5                    | 10.7      | 6.5       |
| 1967 | 4.6          | -0.6                   | 16.1      | 9.6       |
| 1968 | 13.6         | 6.7                    | 13.0      | 9.4       |
| 1969 | 7.6          | 0.6                    | 9.1       | 3.1       |
| 1970 | 6.7          | 3.7                    | 7.2       | 5.1       |
| 1971 | 7.0          | -1.3                   | 8.1       | -0.2      |
| 1972 | 5.9          | 0.7                    | 5.8       | 1.6       |
| 1973 | 6.2          | 0.1                    | 7.9       | 3.8       |
| 1974 | 3.9          | 0.7                    | -0.3      | -1.7      |
| 1975 | 5.6          | 1.6                    | 2.6       | 0.9       |
| 1976 | 6.0          | 2.7                    | 5.7       | 3.3       |
| 1977 | 3.2          | -0.3                   | 5.7       | 2.4       |
| 1978 | 2.9          | 0.8                    | 6.7       | 4.8       |
| 1979 | 6.8          | 1.9                    | 6.3       | 3.2       |
| 1980 | 3.1          | -0.6                   | 3.0       | 0.8       |

Source: Tables B-3 and B-4.

\*Including their domestic operations.

$X_1$  = Tonne-Kilometres Available.

$K_1$  = Capital measured in terms of Aircraft Hours Flown.

$K_2$  = Capital measured in terms of Aircraft Tonne-Hours.

$K_3$  = Capital measured in terms of Number of Aircraft.

$K_4$  = Capital measured in terms of Aircraft Capacity (see definitions in Appendix A).

TABLE B-10

ANNUAL PERCENTAGE GROWTH RATES OF CAPITAL PRODUCTIVITY  
WITH RESPECT TO OUTPUT MEASURED IN TERMS OF TONNE-  
KILOMETRES PERFORMED, INTERNATIONAL SCHEDULED  
AIRLINES,\* ICAO CONTACTING STATES, 1950-1980.

| Year | Growth Rates |                        |           |           |
|------|--------------|------------------------|-----------|-----------|
|      | $X_2/K_1$    | $X_2/K_2$<br>(Percent) | $X_2/K_3$ | $X_2/K_4$ |
| 1950 | -            | -                      | -         | -         |
| 1951 | -1.6         | -6.2                   | -0.8      | -1.1      |
| 1952 | 1.7          | -6.9                   | 1.6       | 2.3       |
| 1953 | 10.0         | 5.5                    | 10.5      | 3.6       |
| 1954 | 9.8          | 3.4                    | 9.2       | 1.6       |
| 1955 | 3.7          | -0.2                   | 4.2       | 3.2       |
| 1956 | 6.9          | 1.3                    | 6.3       | 4.9       |
| 1957 | 3.3          | -0.2                   | 3.3       | 5.0       |
| 1958 | 6.1          | 1.0                    | 9.6       | 5.4       |
| 1959 | 16.7         | 11.3                   | 10.8      | 10.7      |
| 1960 | 14.6         | 3.4                    | 13.0      | 4.5       |
| 1961 | 7.9          | -6.4                   | 6.9       | -12.5     |
| 1962 | 10.5         | -0.3                   | 10.1      | -5.2      |
| 1963 | 10.0         | 3.3                    | 10.7      | 1.0       |
| 1964 | 11.3         | 3.9                    | 13.7      | 5.9       |
| 1965 | 9.3          | 3.3                    | 15.2      | 7.1       |
| 1966 | 9.5          | 4.8                    | 13.3      | 9.0       |
| 1967 | 0.3          | -4.6                   | 11.4      | 5.1       |
| 1968 | 8.8          | 2.2                    | 8.3       | 4.8       |
| 1969 | 5.5          | -1.4                   | 7.0       | 1.1       |
| 1970 | 6.4          | 3.4                    | 6.9       | 4.9       |
| 1971 | 3.9          | -4.1                   | 4.9       | -3.1      |
| 1972 | 11.9         | 6.4                    | 11.8      | 7.3       |
| 1973 | 8.4          | 2.2                    | 10.2      | 6.0       |
| 1974 | 7.1          | 2.1                    | 2.7       | 1.3       |
| 1975 | 3.6          | -0.2                   | 0.7       | -0.9      |
| 1976 | 9.1          | 5.7                    | 8.8       | 6.3       |
| 1977 | 5.8          | 2.1                    | 8.3       | 4.9       |
| 1978 | 9.1          | 6.9                    | 13.2      | 11.2      |
| 1979 | 9.4          | 4.3                    | 8.9       | 5.7       |
| 1980 | 0.2          | -3.4                   | 0.1       | -2.0      |

Source: Tables B-3 and B-4.

\*Including their domestic operations

$X_2$  = Tonne-Kilometres Performed.

$K_1$  = Capital measured in terms of Aircraft Hours Flown.

$K_2$  = Capital measured in terms of Aircraft Tonne-Hours.

$K_3$  = Capital measured in terms of Number of Aircraft.

$K_4$  = Capital measured in terms of Aircraft Capacity (see definitions in Appendix A).

TABLE B-11

ANNUAL PERCENTAGE GROWTH RATES OF LABOR PRODUCTIVITY,  
INTERNATIONAL SCHEDULED AIRLINES,\* ICAO CONTRACTING  
STATES, 1950-1980.

| Year | $X_1/N$ | Growth Rates | $X_2/N$ |
|------|---------|--------------|---------|
|      |         | (Percent)    |         |
| 1950 | -       |              | -       |
| 1951 | 4.4     |              | 2.8     |
| 1952 | -0.2    |              | -0.1    |
| 1953 | 3.3     |              | 3.6     |
| 1954 | 4.2     |              | 2.7     |
| 1955 | 1.7     |              | 0.0     |
| 1956 | 4.6     |              | 7.2     |
| 1957 | 6.6     |              | 6.3     |
| 1958 | 6.9     |              | 6.4     |
| 1959 | 14.1    |              | 14.2    |
| 1960 | 23.9    |              | 15.1    |
| 1961 | 15.5    |              | 8.0     |
| 1962 | 12.7    |              | 10.8    |
| 1963 | 3.3     |              | 2.7     |
| 1964 | 4.9     |              | 6.2     |
| 1965 | 8.2     |              | 9.3     |
| 1966 | 1.2     |              | 3.6     |
| 1967 | 9.9     |              | 5.4     |
| 1968 | 12.7    |              | 7.9     |
| 1969 | 9.3     |              | 7.2     |
| 1970 | 9.6     |              | 9.3     |
| 1971 | 7.9     |              | 4.7     |
| 1972 | 2.9     |              | 8.7     |
| 1973 | 7.8     |              | 10.1    |
| 1974 | 1.1     |              | 4.2     |
| 1975 | 4.1     |              | 2.2     |
| 1976 | 3.9     |              | 7.0     |
| 1977 | 5.1     |              | 7.7     |
| 1978 | 4.5     |              | 10.8    |
| 1979 | 6.0     |              | 8.5     |
| 1980 | 2.1     |              | -0.8    |

Source: Tables B-3 and B-4.

\*Including their domestic operations.

$X_1$  = Output measured in terms of Tonne-Kilometres Available.

$X_2$  = Output measured in terms of Tonne-Kilometres Performed.

$N^2$  = Labor Input measured in terms of Manhours.

TABLE B-12  
PRODUCTIVITY AND OPERATING COST OF SELECTED  
JET AIRCRAFT, 1980.

| Aircraft        | Productivity Factors* |                                  |                                   |                                 |                                  |
|-----------------|-----------------------|----------------------------------|-----------------------------------|---------------------------------|----------------------------------|
|                 | Size<br>(Tonnes)      | Speed<br>(Kilometres<br>per hr.) | Utilization<br>(Hours per<br>day) | Stage<br>Length<br>(Kilometres) | Cost per<br>TKA+<br>(U.S. Cents) |
| Boeing 707      | 20.80                 | 885                              | 8.32                              | 1392                            | 17.85                            |
| Boeing 720      | 16.19                 | 871                              | 7.05                              | 1216                            | 15.37                            |
| Boeing 727      | 18.85                 | 914                              | 7.13                              | 928                             | 14.35                            |
| Boeing 737      | 13.88                 | 917                              | 6.45                              | 624                             | 22.60                            |
| Boeing 747      | 49.15                 | 803                              | 9.22                              | 2874                            | 12.20                            |
| BAC 1-11        | 13.76                 | 816                              | 6.59                              | 344                             | 27.01                            |
| CV-880          | 12.14                 | 744                              | 6.58                              | 1088                            | 13.45                            |
| CV-990          | 13.99                 | 1066                             | 6.54                              | 1454                            | 14.13                            |
| Douglas DC-8    | 21.97                 | 965                              | 9.52                              | 2320                            | 15.59                            |
| Douglas DC-9    | 14.46                 | 903                              | 7.47                              | 364                             | 23.62                            |
| Douglas DC-10   | 35.50                 | 965                              | 7.43                              | 1904                            | 12.77                            |
| F-28 Fellowship | 7.52                  | 687                              | 7.42                              | 384                             | 25.99                            |
| HS-Trident      | 20.70                 | 858                              | 5.57                              | 992                             | 14.24                            |
| Lockhead L-1011 | 39.90                 | 938                              | 6.34                              | 2112                            | 14.80                            |
| VC-10           | 19.66                 | 885                              | 10.50                             | 1472                            | 15.14                            |

Source: United States Civil Aeronautics Board, Aircraft Operating Cost and Performance Report, July, 1980; International Civil Aviation Organization, Digest of Statistics (Financial Data and Fleet and Personnel) 1974; Mahlon R. Straszheim, The International Airline Industry, The Brookings Institution, 1969, Appendixes A and B; and Enzo Angelucci, Airplanes, McGraw-Hill, New York 1973, pp. 254-257.

\*These figures represent arithmetic averages of international/territorial operations.

+Tonne-Kilometres Available.

TABLE B-13  
PRODUCTIVITY AND OPERATING COST OF SELECTED  
TURBOPROP AND PISTON AIRCRAFT, 1980.

| Aircraft         | Productivity Factors* |                                  |                                   |                                 |                                  |
|------------------|-----------------------|----------------------------------|-----------------------------------|---------------------------------|----------------------------------|
|                  | Size<br>(Tonnes)      | Speed<br>(Kilometres<br>per hr.) | Utilization<br>(Hours per<br>day) | Stage<br>Length<br>(Kilometres) | Cost per<br>TKA+<br>(U.S. Cents) |
| <u>Turboprop</u> |                       |                                  |                                   |                                 |                                  |
| Beechcraft B-99  | 1.73                  | 246                              | 4.42                              | 152                             | 57.52                            |
| Convair CV 580   | 5.78                  | 300                              | 4.54                              | 200                             | 44.75                            |
| Convair CV 600   | 4.63                  | 288                              | 5.15                              | 192                             | 50.85                            |
| DHC-6            | 2.20                  | 233                              | 6.40                              | 149                             | 50.96                            |
| Electra L-188    | 10.18                 | 307                              | 5.10                              | 323                             | 44.52                            |
| Fairchild FH-227 | 5.09                  | 256                              | 5.00                              | 176                             | 45.88                            |
| Fairchild F-27   | 4.63                  | 280                              | 6.84                              | 213                             | 50.85                            |
| Herald           | 5.09                  | 336                              | 4.15                              | 184                             | 43.62                            |
| Nihon YS-11      | 6.71                  | 275                              | 6.84                              | 186                             | 32.66                            |
| Nord 262         | 3.70                  | 264                              | 5.76                              | 130                             | 53.56                            |
| Viscount V-700   | 6.36                  | 312                              | 5.85                              | 216                             | 48.36                            |
| Viscount V-800   | 7.52                  | 312                              | 5.70                              | 229                             | 45.77                            |
| <u>Piston</u>    |                       |                                  |                                   |                                 |                                  |
| Convair CV 240   | 4.63                  | 296                              | 5.70                              | 192                             | 42.71                            |
| CV-340/440       | 5.20                  | 312                              | 5.85                              | 203                             | 44.18                            |
| Douglas DC-3     | 3.47                  | 186                              | 3.27                              | 131                             | 45.77                            |
| Douglas DC-6     | 9.83                  | 392                              | 6.32                              | 304                             | 43.84                            |
| Douglas DC-7     | 10.41                 | 432                              | 6.47                              | 400                             | 47.35                            |
| Lockheed 749     | 8.67                  | 344                              | 3.52                              | 320                             | 48.36                            |
| Lockheed 1049    | 9.83                  | 424                              | 4.00                              | 336                             | 46.56                            |
| Martin 202       | 3.47                  | 216                              | 4.30                              | 168                             | 48.36                            |
| Martin 204       | 4.63                  | 221                              | 4.27                              | 130                             | 44.64                            |

Source: United States Civil Aeronautics Board, Aircraft Operating Cost and Performance Report, July 1980; International Civil Aviation Organization, Digest of Statistics (Financial Data and Fleet and Personnel) 1974; Mahlon R. Straszheim, The International Airline Industry, The Brookings Institution, 1969, Appendixes A and B; and Enzo Angelucci, Airplanes, McGraw-Hill, New York 1973, pp. 254-257.

\*These figures represent arithmetic averages of international/territorial operations.

+Tonne-Kilometres Available.



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